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The Automotive manufacturer

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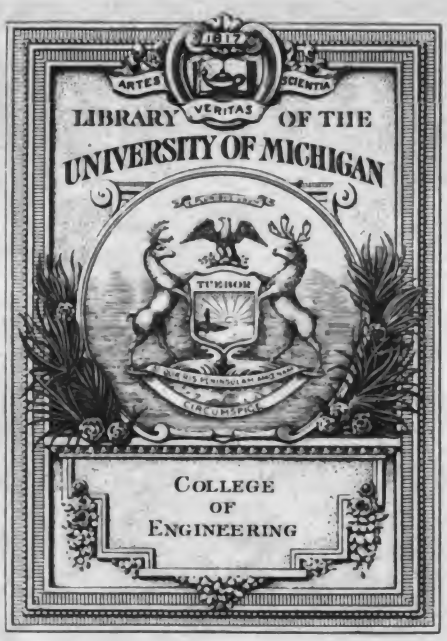

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The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

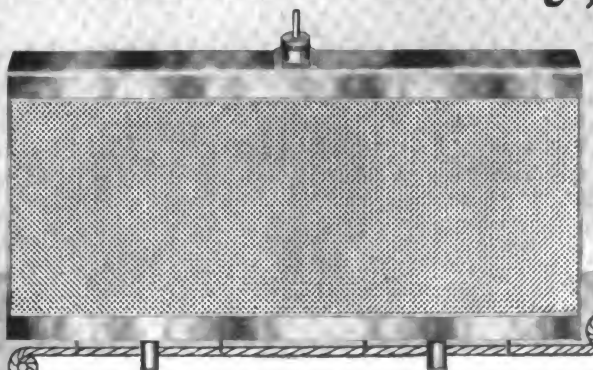
Vol. LXI, No. 6 NEW YORK, SEPTEMBER, 1919 $2.00 Per Year Issued Monthly

G&O Radiators

on

U.S. NAVY SEAPLANES

in record-breaking flight across the ocean



These famous Radiators were selected by the Navy Dep't. for this important flight because of their Absolute Dependability

G & O RADIATORS have again demonstrated their remarkable efficiency in the notable flight of the NC boats—undoubtedly the greatest test to which any radiator could be subjected. All these boats were equipped with G & O Radiators. According to dispatches, the Liberty engines were perfectly cooled during the entire voyage of the NC-4 as well as the NC-1 and 3, which were forced to alight because of fog. G & O Radiators for passenger cars, trucks and tractors possess the same quality in workmanship and material.

THE G & O MANUFACTURING COMPANY NEW HAVEN, CONN.

Published monthly by The Trade News Publishing Co., Edison Building, corner Elm and Duane Streets, New York City
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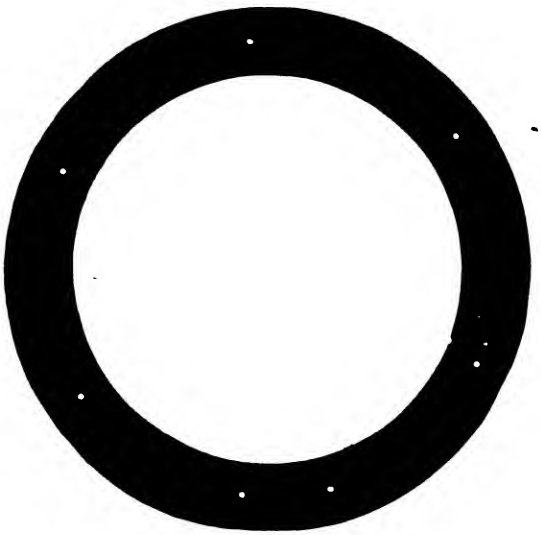
Raybestos
MOLDED CLUTCH FACING
(PATENTED)



Woven asbestos clutch facing when introduced by The Raybestos Company many years ago, initiated a new era in automobile practice. At that time long-fibre asbestos—suitable for weaving high grade clutch facing or brake lining, was plentiful.

Durability in the woven facing is measured almost entirely by the **length of asbestos fibre** employed. But only 10 to 12 per cent of all asbestos mined is suitable for weaving into facings or brake lining capable of sustaining the Raybestos **guarantee.** Only **long fibre asbestos** can be **woven** into heat- and wear-resisting fabric. Shorter fibres necessitate the use of binder and filling which **will not withstand high temperatures,** causing the fabric to disintegrate rapidly and the surface falls to pieces.

The increasing difficulty in obtaining "spinning fibre" (due to growing demand) led Raybestos engineers to investigate the problem three years ago. After two years of tests and experiments, we produced Raybestos MOLDED Clutch Facing. It has since undergone a year's service on a large number of cars in the hands of owners.

Raybestos MOLDED Clutch Facing contains 73 to 75 per cent asbestos, as compared with 40 to 45 per cent for high grade woven fabric. The balance is cotton and brass wire, which does not contribute to wearing surface.

Every part of the surface gives effective power-transmitting contact and 100 per cent friction hold as compared with 50 to 60 per cent for the best woven facing, as only the high spots of woven fabric **take hold.** Woven facing wears down to the wire foundation without bringing more than 70 per cent effective surface into contact.

There is no wire in Raybestos MOLDED Facing to limit service or life. It will wear down to a wafer without causing metal-to-metal contact which destroys efficiency of the woven facing. Raybestos MOLDED Clutch Facing after 15,000 miles service shows scarcely any wear. **We have not yet succeeded in wearing this facing to a point where replacement is necessary!**

Raybestos MOLDED Clutch Facings are *endless.* They are made in one *continuous* ring obviating numerous troubles experienced with the old style woven facing on account of the ends or joint catching in the clutch drum or housing, causing clutch to grate or even causing it to fail to release properly.

THE RAYBESTOS COMPANY, BRIDGEPORT, CONN.

Manufacturers of Raybestos Brake Lining and originators of every worthwhile improvement in brake lining and clutch facing

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Frank Crouch
10-18-66

The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXI NEW YORK, SEPTEMBER, 1919 No. 6

WITH this issue, THE AUTOMOTIVE MANUFACTURER makes its bow under that title, although representing more than 61 years of continuous and progressive publishing experience in the field, dating back to a time before there were any automobiles or other automotive vehicles. It is a consolidation of THE HUB and AUTOMOTIVE ENGINEERING.

The former, devoted formerly to carriage builders and more recently to body and motor builders, has always been a manufacturer's publication and has been published continuously since 1858.

The latter, the first to use and live up to the word "automotive" in its broadest sense, was started in answer to an evident need among manufacturing executives for a publication which would present all phases of the engineering and technical side of this tremendous industry, the basis of which is an essentially technical product and one which requires engineering skill of the highest order in its building.

THE AUTOMOTIVE MANUFACTURER will continue to serve the manufacturers as its name indicates; it will continue the most desirable features of both publications, including body building with working drawings and the related subjects of painting, varnishing, etc., and all such engineering matters as will interest the automotive engineer and vehicle manufacturer. An enlarged editorial staff has been provided to give subscribers this service.

Big plans have been made for the near future, as necessary to carry out our self-imposed task of serving all the needs of the automotive manufacturers. Time was so short for the preparation of the present combination issue and so many of the articles in AUTOMOTIVE ENGINEERING had not been concluded that it does not represent fairly just what THE AUTOMOTIVE MANUFACTURER wants to and intends to be. Subscribers and friends in the industry are urged to write us giving their views on the combination and their suggestions for improvements or for new or different features.

Subscriptions to AUTOMOTIVE ENGINEERING taken at a higher price than that which now obtains will be extended on a pro-rata basis.

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New Duesenberg Racing Engine with Many New Features

All-in-Line Eight-Cylinder Motor Embodies Radical Departures From Current Duesenberg Racing and Aero Engine Practice

ONE of the novelties of the Indianapolis Speedway races was the all-in-line eight-cylinder engine used in the Bablot cars. By a strange coincidence, just at the time these engines were announced, Fred Duesenberg announced that he had designed and built a new racing engine of this type, which had been designed by him last winter while in Florida on a vacation. In this motor, shown herewith for the first time, many of the characteristic Duesenberg engine features are lacking, as for instance the valves. For several years all Duesenberg engines have had horizontal valves, operated by means of long rocker arms. In the new motor short simple valves are located in the cylinder heads, where they are operated by an overhead camshaft through small bell-crank rockers. The overhead camshaft is a departure, as is the arrangement of valves, only two per cylinder and set at an angle of 45 deg. to the vertical.

The bore of this new eight-cylinder unit is 3 in. and the stroke 5¼ in., giving a displacement of 297 cu. in. This is a very long stroke for a Duesenberg motor and gives a stroke-bore ratio of 1.75:1. The cylinders are cast enbloc, with integral water jackets, but have a removable head. The crankcase is of the barrel type, with large hand holes on one side. The shaft has three ball bearings.

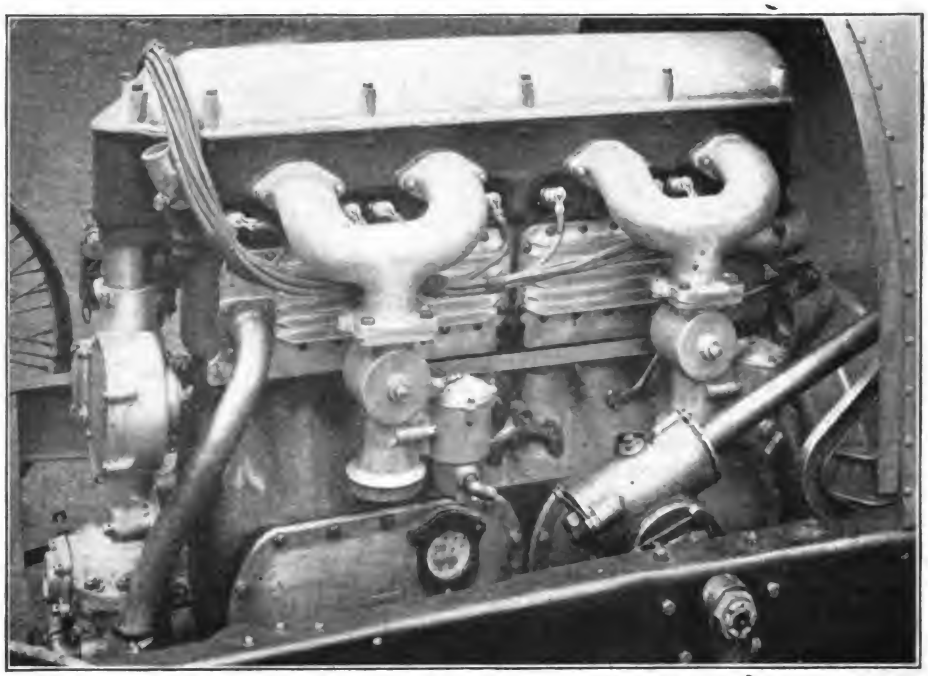

Fig. 2—Inlet side of the all-in-line Duesenberg racing motor, showing carbureters and inlet manifolds

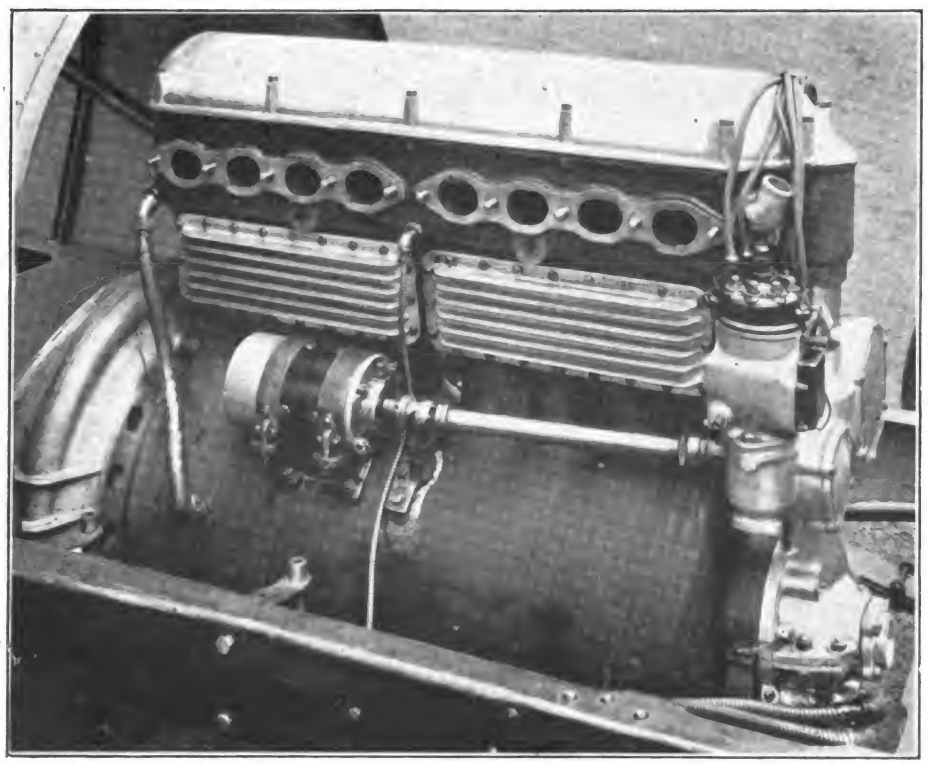

Fig. 1—Exhaust side of the new eight-cylinder Duesenberg engine, showing block casting of cyslinders and removable head

The overhead camshaft is driven by bevel gears from a vertical shaft in front, the distributor and generator being driven through spiral gears by a transverse shaft the latter by means of an extended shaft with universal joints. The water pump is driven from the lower end of this vertical shaft. It delivers water to the front end of the jacket, whence it is bypassed at the rear to the cylinder head. There are two leads, one on either side, at the front part of the upper portion of the cylinder head, to the radiator.

Carburetion is by means of two 1¾ in. Miller multiple jet carbureters, each supplying four cylinders through a two-branched

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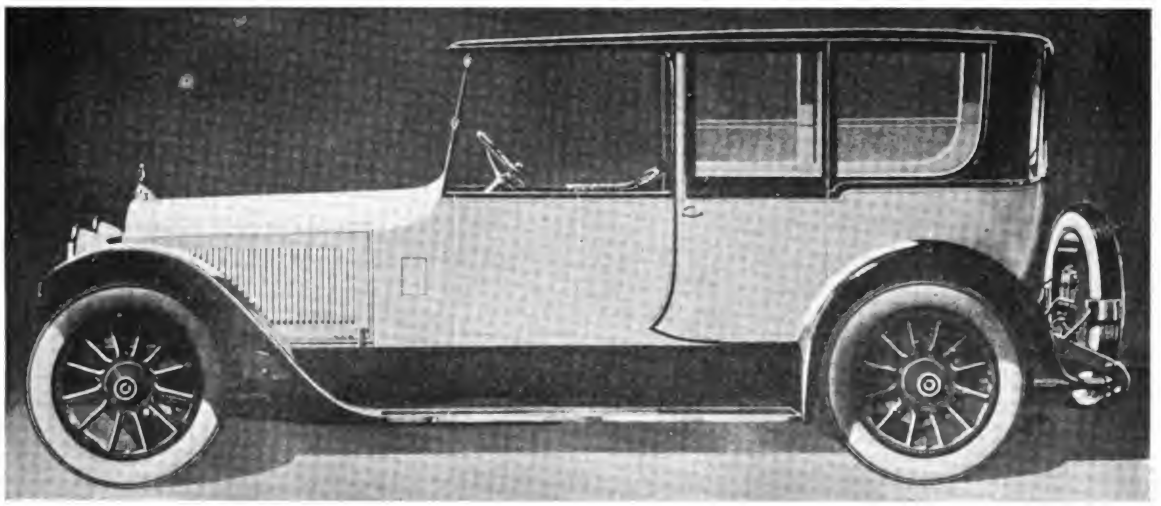
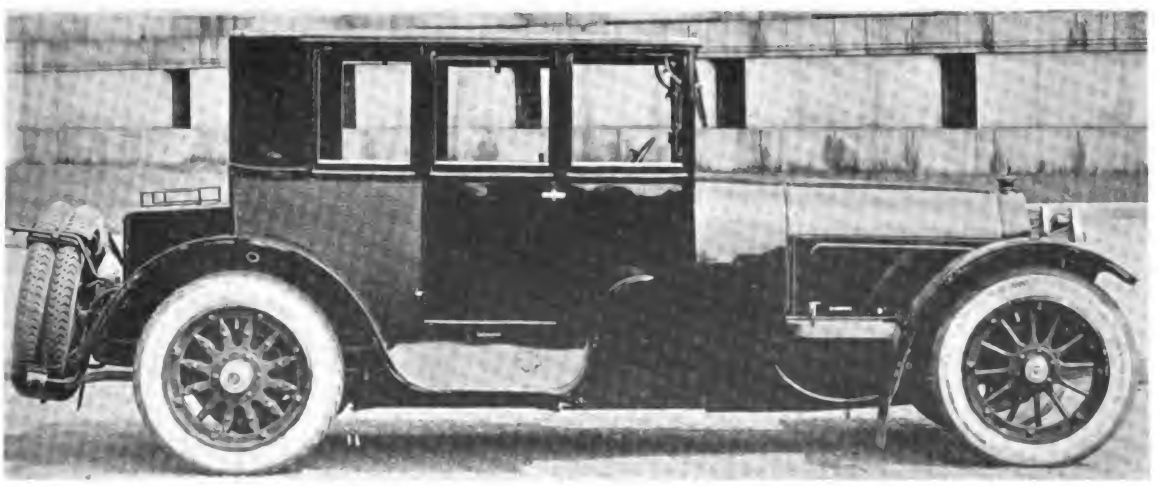


LIMOUSINE
Body built by Rubay Company, Cleveland
Mounted on Packard chassis



SEDAN
Built by Locomobile Co. of America, Bridgeport, Conn.

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manifold. These are on the left side of the motor, with the exhaust pipes on the right, as the views show. Gasoline is fed under pressure created by a hand pump.

Lubrication is by castor oil, circulated by a three-gear pump, drawing from an oil tank. The oil pressure is maintained in the rocker shaft and camshaft enclosure on top of the cylinder heads, with a constant oil level in the crankcase base for the connecting rod splash.

Ignition is by Delco distributor of a special eight-cylinder type, with two generators and one Rajah spark plug per cylinder. The distributor is placed vertically in front on the right side, near the top of the cylinders, while the spark plugs are set into the sides of the cylinders, below the inlet manifold, on the left side. Removable plates on the sides of the cylinders are of cast aluminum with horizontal air cooling fins.

secured fast against the interior of the doors. The rear door pillar collapses on the rear window sill and the rear window pillar, in like manner, collapses against the rear of the body. In addition the roof leather section is hinged in the simple manner of inside folding and places itself naturally on top of the bows.

This new design could be classified under strictly French lines of body building, square and light in appearance. The back of the driver's seat is divided by a narrow second cowl from the rear body compartment, and a fairly high front seat trimming provides here a clever hiding place for the pillars when folded.

As for the chassis, the standard dimensions are retained. We will note a specially formed radiator, which always secures a certain foundation to the whole car. The combination of the rounded lines of radiator, mud guards and the rear part of body, in contrast with the square-lined

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SEVEN-PASSENGER TOURING LANDAULET

Ideal Car Serial—No. 8

Seven-passenger Touring Landaulet

Specially designed for The Hub
By BEDA BROZIK

In this month's issue we have selected for our readers a new type of all-year-car, a seven-passenger touring landaulet. The body is equipped with a collapsible folding system very similar to that of a town cabriolet, differing only in the construction by adding a "quarter-light" window to the rear leather section and forming the appearance of a landaulet. To convert this closed body into the comforts and advantages of a touring car it requires no more than 40 minutes of time for one man.

First of all the window glass has to be lowered to the level of the window sills. To secure this, the rear window is divided in two parts and lowered to the extreme point of the wheel housing in a parallel direction. Behind the driver's seat the front door pillars are folded crosswise, and by opening the door the folding window frame is

Jackson Motor and United F-W-D Truck Merger

The Jackson Motor & Mfg. Co., Jackson, Mich., and the United Four Wheel Drive Truck Corp., Chicago and Port Jefferson, L. I., have been merged under the name of the Jackson Motors Corp., with a capital stock of $5,000,000. H. A. Matthews has been elected president; W. W. Sterling, Boston, vice-president; Carl L. V. Exselsen, Chicago, attorney and president Portage Silica Products Co., Portage, Wis., secretary; and F. O. Evans, president Evans Art Piano Co., Chicago, treasurer. Besides the officers, the board of directors includes C. O. Minger, president Electric Auto Light Co., and a vice-president of Willys-Overland, Inc.; F. E. Mosher, secretary and general manager Covert Gear Co., Lockport, N. Y.; Chrispon Oglebay, president and general manager Ferry Machine & Foundry Co., Cleveland; G. W. Rogers, Goodyear Tire & Rubber Co., Akron, O.; and F. C. Matthews, formerly superintendent and secretary Jackson Motor & Mfg. Co. The new concern soon will increase its working force to 1,000.

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Improved Methods of Finishing Bodies for Automobiles*

How the Painting and Upholstering Departments Can Be Organized and Systematized for Larger Production and Superior Work—Benefits of the Bonus Plan for Cutters—Details of the Arrangement of Equipment, Processes of the Work, and Machinery

By C. A. MARSTON†

External finish and internal body trimming are the first things ones sees, in addition to the body lines when looking at an automobile.

The more expensive the machine the more attractive and better the external and internal finish to be expected. Good painting, trimming and internal arrangement usually decide the sale of the car, provided it is satisfactory mechanically. There is no doubt but that a little better than the average painting job will sell a car when perhaps another, mechanically superior, will be turned down because it did not look quite so attractive or classy.

Those old line companies that had long years of experience in finishing the better grades of cars and carriages, had quite a start over the new automobile companies when the former decided to stop building carriages and go into the automobile business.

The methods employed for painting carriages, however, did not quite adapt themselves to the enormous automobile output required, and cheaper and more efficient methods were necessary.

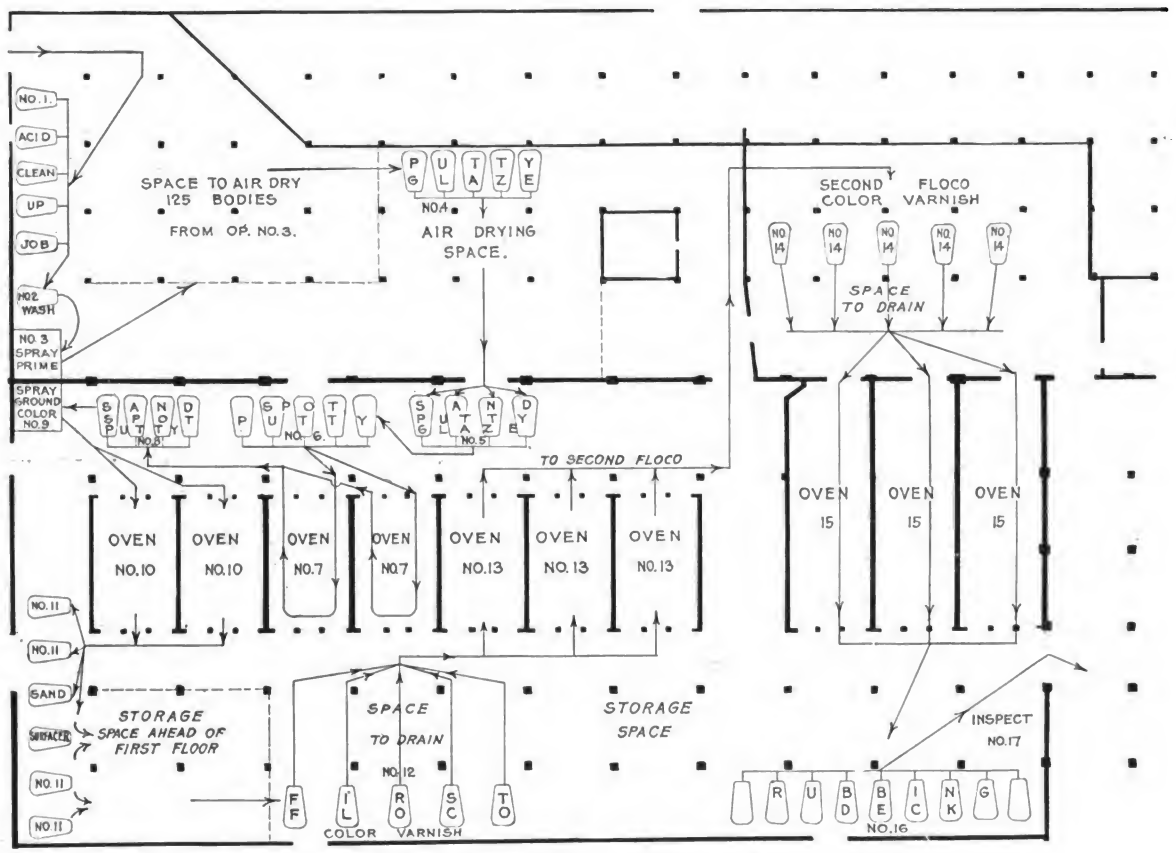

Fig. 1—Diagram showing various operations involved in painting automobile bodies

Many things can be said about the old hand painted carriages with their fancy colors to satisfy each customer's color scheme, and even today these same methods and ideas are necessary in the expensive cars and special color work.

Commercial automobile painting is divided into three classes: First, the hand finished job, with which we are so familiar and on which the various coats are applied with a brush. Second, the enameled and baked finish, which is so easily and quickly applied and so good looking even after several years of service. The Dodge and Ford cars are typical examples of enameled work which always

*Courtesy Industrial Management.

†The author outlines the general procedure in finishing automobile bodies and then takes up in detail an arrangement of equipment, processes of the work and utilization of conveying machinery. An important feature is the use of a double bonus plan for the cutting department that includes two factors: the number of jobs cut and the amount of leather used per job.

Mr. Marston learned the trade of machinist and tool maker, working for several well known firms, including the United States Shoe Machinery Co. Then for three years he was chief inspector at the Blake & Knowles Steam Pump Works, leaving that position to take up production and industrial engineering. To this latter work he has given ten years of effort installing planning methods, taking time studies, setting rates and reorganizing departments for a number of firms, including the Minneapolis Steel Machinery Co., Timken Detroit Axle Co., and Kelsey Wheel Co. He is at present general superintendent for the Bijur Motor Appliance Co.

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looks well and never seems to dull, crack or peel off. Third, there is the Floco process, whose name is taken from the method by which it is applied. The Floco process flows the color varnish over the body, through a pipe and nozzle, the surplus of each coat being caught in troughs, strained and pumped back to receiving tanks, from which it is drawn and reused over and over again.

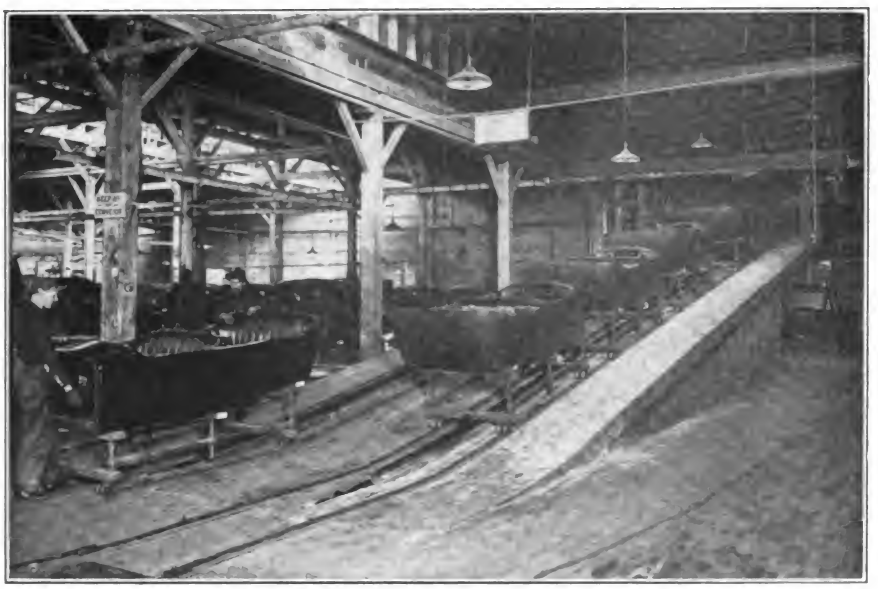

Fig. 2—Automobile body conveyor for moving from one operation to the next

The first or brush method is applied to all the very expensive and small quantity production jobs. Many manufacturers insist that they get a better finish this way than by any other, all of which may or may not be the case.

There is, however, no comparison between the labor cost of a hand finished job versus enameling or flocoing. Enameling, on the other hand, cannot be applied to any automobile body on which the internal construction is wood. This in itself limits the quantity of enameled jobs and brings it down to a very small number of manufacturers. The reason is because the high heat (some 300 deg. F.) required to bake the enamel would char and render useless any of the wooden types of construction.

On the other hand it is no doubt quite true that a large number of manufacturers would enamel their product to the better satisfaction of all if they could secure other colors than black, and if they did not change the body design each season. The cost of making the necessary tools for a metal body each year is the controlling feature, and it is only with companies like Ford and Dodge that rarely change design, that these methods can be considered advisable.

Small objections are found with all the present methods of painting. The Floco, which is described in this article, is used by Buick, Hupmoble and others, with remarkable success and at a very low labor cost, the time taken being under five minutes per body. The only objection to this method is the claim that as the color varnish rubs off the job it thins out at the top and builds up on the lower sections. A careful comparison, however, between the average finished job and the Floco will usually show that the Floco is the smoother of the two. There will be practically no dust or specks on the surface and no brush marks whatever. Of course, the filtering process for the returned varnish must be carefully handled and the filtering medium must not be thin enough to take out the pigment. Even under the best of conditions color must be added to the working tanks to keep the same at the proper shade or tint.

Operations in Body Painting

The operations in painting an automobile body used by a firm turning out about 75 per day are indicated on the layout drawing, Fig. 1.

The progress of a body from its entrance, shown in the upper left-hand corner, to its exit near the lower right-hand corner, is indicated by a series of lines and arrows. Each operation is numbered and the location in which it is performed is indicated. Furthermore, in several places diagrams show how many bodies are either in storage or in process at the same time. The following numbered items refer to the operations whose locations are indicated by numbers on the figure.

1. Take off rust and clean.
2. Wash in warm water.
3. Spray priming or preparatory coat.
4. Putty glaze.

Fig. 3—Upholstering, or hanging the backs

(It should be noted that the drawing of Fig. 1 is to scale, and the size of the bodies, the working spaces around them, and the ovens are all in true proportion).

5. Sand putty glaze.
6. Spot putty to fill in seams, hollows and the like.

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7. Dry in oven at 90 to 100 deg. F.
8. Sand spot putty.
9. Spray on the ground color.
10. Oven dry.
11. Put on surfacing coat and sand.
12. Apply Floco varnish using four troughs. (See Fig. 4). Bodies are drained before drying.
13. Dry color varnish at a temperature of 90 to 100 deg. F.
14. Apply second coat of Floco color varnish.
15. Dry over night.
16. Rub down. (Note that there is space for nine bodies and 18 men, using two men to a body).

The bodies are now inspected and any "dings," that is any dents in the metal, are removed by the "ding" man or inspector. All the work up to this time has been done on the ground floor and the presence of small quantities of dust is not seriously objected to.

Body Conveyor

Fig. 2 shows the body conveyor which takes the bodies from the rubbing deck up to the finishing rooms and returns the bodies after they are completely finished. It will be seen that one set of the conveyors is taking up the bodies ready for the final varnishing and upholstering, while the other side of the conveyor is bringing bodies back after they have been completed. In the background can be seen a body still further completed.

Fig. 5—Detail view of the process of flowing the finishing varnish

This conveyor is made in such a way that pushers are placed at intervals to take the body trucks. The conveyor is slow moving and continuous in operation, which means that it needs constant attention to load at the bottom and unload at the top.

Hanging the Backs

The operation of upholstering, or as it is known in the trade, hanging the backs, is shown in Fig. 7.

Fig. 4—Operation of final varnishing

Two men form the gang and most of the work is either done on contract or is paid for under the premium plan. The necessary materials as leather and linings are cut and delivered to the gang. Stuffing material is supplied in bulk. At the right of the illustration can be seen bales of hair and sea moss. In general, materials are brought to this floor at night to be in readiness for the next day's work. Each set of leather which represents a considerable sum of money is charged to the gang that received it from a special stock room.

After the backs are hung the bodies are sent to a room to receive the final flow of varnish. See Fig. 4.

This process is plainly shown in the foreground of this illustration and in some detail in the following Fig. 5.

Only a small amount of brush work is required, that is around the top of the doors and the backs of the seats. It will be noticed that the varnish drips or flows into paper lined troughs which drain into pipes. It will be noted further in Fig. 4 that two sets of pipes are suspended from the ceiling. One carries blue color varnish and the other gray. These were the only two colors used in the plants where the photographs were taken.

Drying the Final Coat

An oven used in baking or drying the final coat of varnish is shown in Fig. 6. Much experimental work has been done in an endeavor to develop a perfect drying oven and nearly every body-making plant has a different design. Some have open troughs for water to humidify the air; others use mechanical humidifiers for the same purpose, and still others have no such devices. The one shown is made of double Beaver Board sides and is equipped with recording thermometers placed on the outside to assist in holding the temperature from 90 to 100 deg. F. The heat comes from steam pipes laid in the floor and plainly seen in the illustration. This arrangement tends

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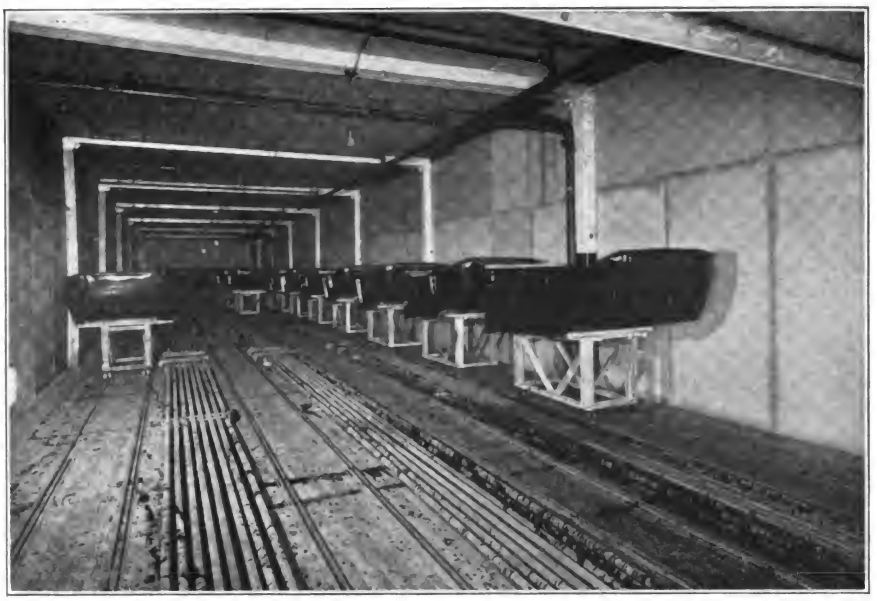

Fig. 6—Oven for drying final coat of varnish

Fig. 7—View in the upholstery sewing room

Fig. 9—Putting on body tops

to cause any loose dust to rise from the pipes and is slightly objectionable for this reason. From some viewpoints it is better to have the heating process overhead, but this arrangement has the objection of indirectness in transferring heat.

However, the arrangement must be made to have the final painting done away from all dust and particles until the varnish is throughly dried and hardened.

Sewing the Upholstery

Fig. 7 shows the sewing room where the leather for the upholstery and materials for the top is lined and sewed.

In this department all leather is requisitioned on a card, see Fig. 8. The inspector punches the number of jobs done each day and all material is charged to the girl and checked against the work finished. All of this work is done as piece work based on time studies.

Fig. 9 shows the operation of putting the tops on the bodies. The bodies are made over bucks or large jigs. A number of completed jobs can be seen hanging on a horse at the right of Fig. 9. Fig. 10 shows a special truck filled with tops ready for the final assembly. The conveyor on which this truck runs is similar in construction to the type of conveyors used in most automobile body building plants.

Leather Cutting Bonus

The upholstery leather used on automobile bodies is quite expensive and its economical use is determined by the skill and willingness of the cutter. The hides reach the cutting department marked with the number of square feet that each contains. To prevent the wastage of leather some incentive must be given to the cutter to induce him to exercise due care and diligence.

A satisfactory way for obtaining this object is to make use of a double bonus which takes into account both the amount of work that the cutter does and the amount of material that he used in each job. In one particular case the chart, see Fig. 11, shows the bonus schedules were as follows: The piece work prices were originally based on a high production and the men were turning out something like 20 jobs per day each. It was not possible to do so much as this and at the same time exercise care in laying out. The forms for cutters are made of metal and the placing of them resembles the piecing together of a puzzle. No two

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hides are alike. After making a careful time study of this job it was found that while the men were using about 74 sq. ft. of leather per job 70 sq. ft. are quite sufficient on the average.

After careful study it was decided to fix a quantity bonus of 3 cents per sq. ft. for each foot saved under 70,

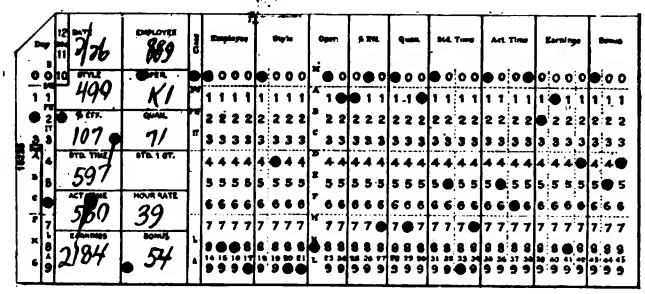

Fig. 8—Leather requisition card

and to exact a penalty of 3 cents per square for every foot used over 70 sq. ft.

Sixteen jobs per day was considered 84 per cent efficient and the schedule of wages earned corresponded with increases in this efficiency up to the limit of 100 per cent; that is, the basis for a day's work was 16 jobs yielding

Fig. 10—Truck load with finished tops

$5.06 with a bonus increase depending upon the amount of leather used less than 70 sq. ft. per job.

After this was put into effect the average number of jobs per day came to 19 and the amount of leather used dropped down to 67 ft. per job. That is, an average man's wages were $6.01 for the quantity output, and 9 cents more for the saving in material, making a total of $6.10

Warning to Infringers of Body Patent

The Perfection Automobile Body Co. has sent out a warning to infringers of the Rothschild automobile body patent which covers a peculiar form of body construction. The construction involved applies particularly to enclosed bodies, and is a method of avoiding the use of external moldings in joining the sheathing of upper and lower sections of the body. For this purpose the sheathing of the upper section is turned under the edge of a bar, bent to conform to the body, which itself is secured to the framework from the inside, thus clamping the sheathing in place. The patent, No. 889,402, was issued to Maurice J. Rothschild in 1908, and by him assigned to the Rothschild Body Co., which has since gone out of existence. It is now owned by the Perfection Automobile Body Co., of New York, which exacts a fee for its use.

Among users of this construction are the following concerns: Locomobile Co. of America, Fisher Body Co., Blue Ribbon Carriage and Auto Co., Willoughby Co., Biddle & Smart Co., Winton Co., New Haven Carriage Co., Holbrook Co., Racine Mfg. Co., Hollander & Morrill, Inc., Currier Cameron Co., Rubay Co., Farnham-Nelson Co., Charles Albresch Co., and Locke & Co.

N. I. V. A. Convention

The National Implement and Vehicle Association will hold its twenty-sixth annual convention at the Congress Hotel, Chicago, October 15-17. Plans are well under way for an attractive program, and several speakers of nation-wide repute will be assigned subjects. It is the intention to make the convention this year of special practical value, especially with reference to matters dealing with reconstruction work in the implement industry.

Approve Standard Tread Wagons

Information has been received by the National Implement and Vehicle Association that the United States Department of Agriculture has officially approved the adoption of the standard 56 in. width of tire for farm wagons. Before making this step the department sent questionnaires to farmers, dealers, extension men and county

John Doe Motor Car Corporation. April 2, 1918

LEATHER CUTTING DEPARTMENT

LEATHER CUTTING BONUS		
EFFICIENCY	JOBS CUT PER DAY	WAGES EARNED
100%	20.00	$6.33
99	19.75	6.25
98	19.50	6.17
97	19.25	6.09
96	19.00	6.01
95	18.75	5.93
94	18.50	5.85
93	18.25	5.77
92	18.00	5.69
91	17.75	5.61
90	17.50	5.53
89	17.25	5.46
88	17.00	5.38
87	16.75	5.30
86	16.50	5.22
85	16.25	5.14
84	16.00	5.06
83	15.75	4.98
82	15.50	4.90
81	15.25	4.82
80	15.00	4.75

BONUS FOR SAVING LEATHER	
FEET CUT PER JOB	BONUS EARNED
65 Ft.	0.15
66	0.12
67	0.09
68	0.06
69	0.03
70	0.00
-	Loss
71	0.03
72	0.06
73	0.09
74	0.12
75	0.15

Fig. 11—Leather cutting bonus chart

agents to determine their attitude on the matter and with few exceptions the replies were favorable to the standard tread. The department suggests that the universal adoption of this tread for all farm wagons will facilitate the maintenance of roads as well as make it possible for farmers to travel the same track on dirt roads that the automobiles use.

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Fig. 5—Quartering front view of the Vickers-Vimy two-engined bombing biplane with which Alcock and Brown accomplished first non-stop trans-Atlantic flight

The Successful Trans-Atlantic Flight--II

Machines and Men Which Attempted This Epochal Flight, and Their Varying Successes. Details of Engines, Planes and Equipment

(Continued from page 216, May issue, Automotive Engineering)

WHEN the mammoth dirigible R 34 arrived at the Pulham, England, aerial station, completing the return trip successfully, it became the first lighter-than-air craft to make the eastward trip across the Atlantic and the first to make the round trip, inasmuch as the westward trip had previously been accomplished not without some difficulty in 108 hours 12 minutes. The net elapsed time for the return flight was 74 hours 57 minutes. The useful load which the R 34 can carry is 25 tons, so that this flight may prove to be the forerunner of actual passenger and freight service across the ocean via air.

Some weeks previously Alcock and Brown in the Vickers-Vimy bombing plane were successful in a single non-stop flight across, covering the 1,936 miles estimated distance in 16 hours 12 minutes corrected time.

The huge Handley-Page machine, the largest attempting the crossing, required so much time for assembling and preparation that it was beaten by the Vickers-Vimy. Later a non-stop flight to New York was started, but in a forced landing near Parrsboro, Nova Scotia, it was rendered useless for further flying. The other competitors withdrew immediately, except Raynham in the rebuilt Martinsyde.

Lieut. Read in the N C 4 arrived safely at Lisbon, completing the actual transatlantic flight started from Rockaway Beach, flying the last leg at an average speed of 82.2 m.p.h. Leaving Lisbon, he was forced down at Mondego River, Portugal, by a water jacket leak. He reached Ferrol that night and the next morning flew to Plymouth. The entire scheduled trip was completed with three of the

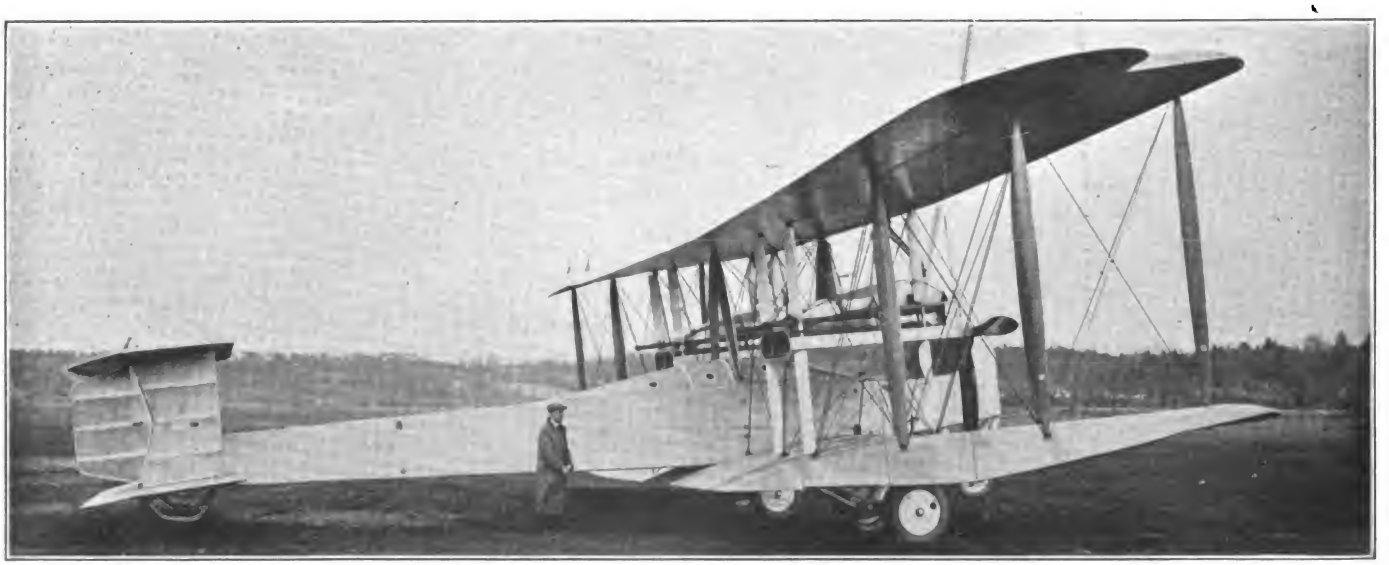

Fig. 6—Side view of the Vickers plane, showing depth of gap and of fuselage by comparison with man on the ground

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original engines, considered a great triumph for the Liberty engine, inasmuch as the actual time in the air totalled 57 hours 16 minutes.

Lieut. Roget, a French aviator, started from Villacoublay in a westward transatlantic flight, via Morocco, in May, but was obliged to descend at Kenitra, 20 miles from Rabat. He covered 1,288 miles at an average speed of 112 m.p.h. In June, Lieut. Fontan made his fourth unsuccessful attempt over this route, his machine being destroyed in a forced landing at Moncayo, 40 miles northwest of Saragossa, Spain.

Details of the Engines and Planes.

Full details of the various planes and motors are not available, but the following gives a general idea of their construction:

Practically all the British airplanes use one or the other of two Rolls-Royce engines, but one machine employs the Napier Lion. These might be described as follows:

R. R. Falcon 3, rated h.p. 220, type V-60 deg., cylinders 12, bore 4 in., stroke 5¼ in., normal h.p. 270 at 2,200 r.p.m., maximum h.p. 280 at 2,300 r.p.m., compression ratio 5.3 to 1, piston speed 2,108 ft. p.m., m.e.p. 114 lbs., water cooled, firing order R 1, 2, 5, 4, 3, 1, 6, 5, 2, 3, 4, 6, valve 1 inlet 1 exhaust per cyl., inlet valve diam. 1.7496, lift .4437, area 2, 4211, exhaust valve same except lift .4400, two carbureters type C. H. 38 M, two Watford magnetos rotating 1.5 times engine speed weighing 14.25 lbs. each, 1 rotary oil pump, 1 centri. water pump, 2 plunger type air pumps weighing 2.75 lbs. each, gear reduction of .59 to 1 gives propeller speed of 1,300 r.p.m., overall length 72.04 in., width 37.24 in., height 42 in., fuel consumption per b.h.p.hr. 56 pints or 53 lbs., oil. 0.26 pints or .026 lbs., combined fuel and oil per b.h.p.hr. .586 pints or .559 lbs., wt. engine dry 723 lbs. or 2.68 per b.h.p., wt. in running order except fuel oil and tanks 912 or 3.38 per b.h.p., wt. with supplies for 6 hours running 1,880 or 6.9 per b.h.p., torque 694 lbs.-ft., estimated b.h.p. at 6,000 ft. 227.4, at 10,000 ft. 201.3, at 15,000 ft. 171.8, at 20,000 ft. 147.6, estimated fuel consumption pints per hour ground level adj. of carb. no altitude control at 6,000 139.8, at 10,000 131.5, at 15,000 121.6, at 20,000 112.7.

R. R. Eagle 8, rated h.p. 360, type V-60 deg., cylinders 12, bore 4½, stroke 6½ in., normal h.p. 350 at 1,800 r.p.m., maximum 360 at 1,900 r.p.m., compression ratio 5.3 to 1, piston speed 1,950 ft.p.m., m.e.p. 124 lbs., water cooled, firing order same as Falcon, valves 1 inlet 1 exhaust per cyl., inlet valve diam. 2.0000, lift .4850, area 2.9155, exhaust valve same except lift .4800, 2 carbureters type C H Duplex 44 mm., weight 13.00 lbs. each, 4 Watford magnetos, 2 gear type oil pumps, 1 centrif. water pump, 1 plunger air pump, gear reduction .6 to 1 gives propeller speed of 1,080 r.p.m., overall length 75.98 in., width 42.52 in., height 48.03 in., fuel and oil consumption practically same as Falcon total both per b.h.p. .585 pints or .528 lbs., wt. of engine dry 933 lbs. or 2.66 lbs. per b.h.p., wt. in running order except fuel oil and tanks 1,177 lbs. or 3.37 lbs. per b.h.p., wt. with supplies or 6 hrs. running 2,406 lbs. or 6.9 lbs. per b.h.p., torque 1,020 lbs.-ft., estimated b.h.p. at 6,000 ft. 289.5, at 10,000 ft. 256.2, at 15,000 ft. 218.75, at 20,000 ft. 188, estimated fuel consumption pints per hr. ground level adj. of carb. no altitude control at 6,000 ft. 178, at 10,000 ft. 167.4, at 15,000 ft. 154.8, at 20,000 ft. 143.5.

Napier Lion, rated h.p. 450, type W-60 deg., cylinders 12, three groups of four, each in a block, bore 5½ in., stroke 5 in., normal speed 1,925 r.p.m., gear reduction 1.52 to 1 gives propeller speed of 1,265 r.p.m., fuel consumption .57 pints per b.h.p.hr., weight complete without fuel oil or tanks 850 lbs., weight per b.h.p. 1.89, 1 centrif. water pump, 3 gear type oil pumps running at half crankshaft speed, 2 magnetos, 2 sets spark plugs, 2 Claudel-Hobson carbureters. Although theoretically not in balance the running is very smooth, and high normal speed of 1,925 proves that it must be. Cylinders are disposed in fan shape, the center block vertical, other two at 60 deg. on either side. A single crankshaft is used, with connecting rods for side blocks of cylinders attached to lugs formed on master rods. This gives longer stroke for these cylinders, but in actual practice this has no effect on the balance, smooth running, or power output.

The Sopwith machine is a two-seater with side by side seating, the seats being slightly staggered, span of wings 46 ft. 6 in., chord 6 ft. 3 in., length 32 ft., gap 6 ft., area main planes 441 sq. ft., wings have no stagger, fuel capacity 330 gal., oil 24 gals., water 17 gals., wt. empty 3,000 lbs., loaded 6,150 lbs., but with undercarriage dropped several hundred pounds less. Fuselage is boat shaped and water tight, rear end being detachable and forming small boat. Estimated speed 100 m.p.h., increased to about 118 by dropping undercarriage. Estimated to require 19½ hours to cross, but fuel provides 25 hours flying.

The Martinsyde plane is also a two-seated biplane, span of wings 41 ft., length 26 ft., weight 5,000 lbs., fuel capacity 360 gals., giving flying radius of 2,000 miles against a 20-mile head wind,

The Short biplane is of the so-called Shirl type, with a span of 62 ft., length 37 ft., chord 8 ft. 6 in., gap of 6 ft. 6 in., area of main planes 1,015 sq. ft., carries 650 gals. fuel in torpedo-shaped tank 18 ft. by 3 ft. 2 in., giving flying radius of 42 hours. Weight 4,800 lbs. Estimated speed 85 to 95 m.p.h.

The Fairey biplane is a bomber of the 3C type, having a span of 46 ft. 6 in., and an overall length of 36 ft. It has variable camber wings supposed to give very high speed when in the air and flying along on level. It is rated at 120 m.p.h. and carries 385 gals. fuel, sufficient for 17½ hours flying.

The Boulton and Paul biplane is a three-seater of so-called Bourges type. It is powered with either 2 BR 2 rotary engines or 2 ABC Dragonfly radial motors. The former is a 9 cylinder unit of 6.72 bore and 6.66 in. stroke, developing 242 h.p. at 1,350 r.p.m. The latter has cylinders of 5.5 in. bore by 6.5 in. stroke and develops 350 h.p. at 1,750 r.p.m. Later advices indicate a crew of four, two Napier Lion engines developing 900 h.p., and expected to cross in 16 hours.

The Felixstowe, or P.S.B., is a huge British modification of the Curtiss flying boat type, resembling the Nancy boats closely. Span is 123 ft., length of fuselage 60 ft., height from keel to ring post 27 ft. 6 in., total weight 23,400 lbs., power 5 Rolls-Royce Eagle 8 engines giving 1,800 h.p. These are set in pairs two-blade propellers on front engines, four-bladed pushers on rears. Fifth engine set centrally at rear. Crew six or seven. Estimated speed 105 m.p.h.

The Handley-Page biplane shows similarity to Felixstowe and Nancy machines, except that it carries no hull. It has span of 130 ft., length 75 ft., height 23 ft., weight

(Continued on page 33)

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Conveyors Speed Assembly

Parallel Chain and Roller Lines Effect Economies in Motor Plant

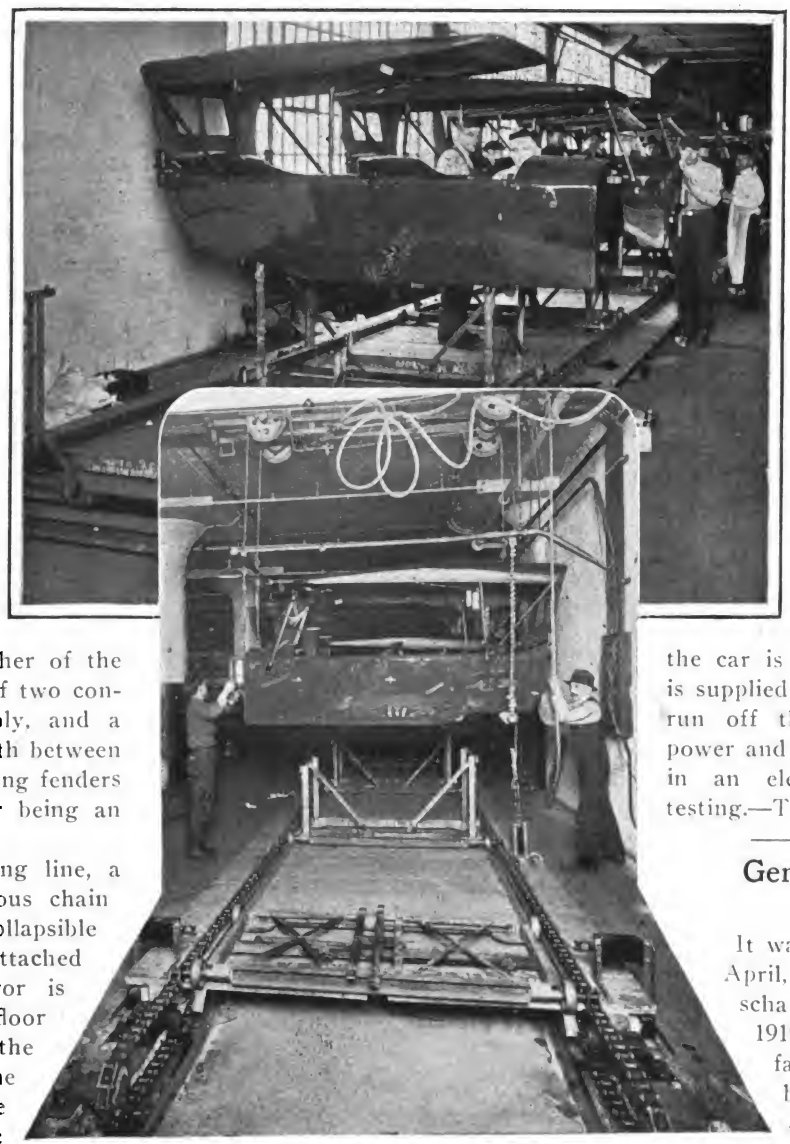
An important improvement in handling methods used in the progressive assembly of automobiles has recently been developed at the plant of the Hudson Motor Car Co., Detroit. Usually car chasses and bodies during the final assembly are placed on cradles fitted with rollers, which are moved through the assembling department by hand or power. This necessitates the use of a large number of cradles, and the empty cradles take up a large amount of floor space and require a certain amount of labor in returning them to the loading points.

In the new Hudson final assembly department the use of the ordinary type of cradles is entirely eliminated, space is otherwise conserved by a compact arrangement, and increased economy has been effected. The assembly of cars is done on three parallel lines, one for bodies with a conveyor 300 ft. long, another of the same length consisting of two conveyors for final assembly, and a third line shorter in length between the other two for attaching fenders to the bodies, the latter being an overhead line.

In the body assembling line, a special type of continuous chain conveyor to which collapsible cradles are permanently attached are used. The conveyor is raised slightly from the floor to provide room for the moving mechanism. The bodies are placed on the cradles by a pneumatic hoist after they have been painted and the top attached, and while the bodies are passing down the line the levers, vacuum gasoline tank, and all the body fixtures are attached. An automatic trip is provided at each end of the conveyor, the one at the lower end causing the cradle to fold up after the assembled body is removed, as shown in one of the illustrations. After the crade has traveled back to the upper end of the conveyor under the platform, it unfolds automatically into its upright position. The capacity of the conveyor is 35 bodies.

Near the end of the body assembly line the body is picked up by an overhead pneumatic hoist and conveyor and carried across to an overhead line along which the bodies move by gravity on rollers. The only operation here is the putting on of the fenders. This line is built on a platform, storage space for fenders being provided under the conveyor, and under the platform beneath parts are kept for the body assembly line and for the final assembly line on each side.

Final assembling is done on two lines. The chasses come from the lower floor with the wheels and tires on and during the final assembly the chasses move lengthwise along two chain type conveyors, the car wheels resting on the conveyor chain. This method represents a departure from the usual practice of placing the chasses sideways on cradles in the final assembly line, and results in a large saving of space as well as the elimination of cradles. Here the controls are attached, bodies are put on and the controls are connected to the bodies. A pneumatic hoist and conveyor carries the bodies across from the overhead body line to the final assembly line. After the car is completely assembled it is supplied with gas, oil and water, run off the line under its own power and taken to the lower floor in an elevator ready for final testing.—The Iron Age.



A folding cradle on a conveyor supports the body during assembly. At the end of the line the assembly is completed, the body raised and the cradle is automatically folded and then conveyed on the under side of the platform back to the beginning of the conveyor line

German Post-War Conditions

It was reported at the end of April, 1919, says the Wirtschaftliche Demobilmachung, 1919, No. 98, that the manufacturers of trucks would be fully employed at least till the end of September on orders of the army administration and its selling department. The government will take over the entire production of these factories. A truck may be sold to a private party on official permit only. Manufacturers of passenger automobiles are not restricted in their sales to private parties, as the government will take over only a small number of automobiles. The factories are fully employed as the demand for passenger automobiles is very strong at this time. In addition, the factories have to fill a number of orders which were accepted in war time on the condition that delivery should not be demanded until three to six months after the conclusion of peace. In the situation of this industry no

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change can be expected within the next few months. The sellers of passenger automobiles may encounter difficulties only when American competition shall have reappeared. Firms manufacturing automobile parts and accessories are fully employed as far as they are supplied with raw materials. The manufacturers of rubber tires will be supplied by the war organization with raw materials until about August 1 or September 1. The materials available will be exhausted by that time, and the factories will have to close unless rubber can be imported.

To Co-operate in Study of Fuel Problem

Further steps toward closer co-operation between the producers of gasoline and the automobile industry, with a view to insuring an efficient as well as an ample supply of fuel for the automotive industry were taken at a meeting in the University Club, New York, on August 21, by representatives from the oil refiners and the automotive industry, with John N. Willys acting as chairman.

Final assembly operations at the plant of the Hudson Motor Car Co. The views show the overhead body line on which fenders are attached; the beginning of the two final assembly lines with the chassis on chain conveyors; the body being lowered upon the chassis with a pneumatic hoist

At this gathering it was decided that while a fixed specification for motor fuels was not desirable, it was highly important that flexible specifications should be agreed upon by the technical representatives of the oil men and the automotive industry so that engineers may know far enough in advance the grade of gasoline to be supplied so that engines may be properly designed to use it efficiently.

A resolution adopted in connection with this co-operative works calls for research work on fuel problems in the laboratories of both the oil and the automotive industries, with the proviso that if the desired results are not obtained in this manner a central laboratory will be equipped for the sole purpose of research work on motor fuels.

John N. Willys, president of the Willys-Overland Co. and chairman of the automotive industry committee, presided at the meeting, which was attended by representatives of the National Automobile Chamber of Commerce, Society of Automotive Engineers, the Motor and Accessory Manufacturers' Association, and by leading oil men of the American Petroleum Institute.

C. B. N. A. Convention Program

The forty-seventh annual convention of the Carriage Builders' National Association will be held at the Hotel La Salle, Chicago, September 23 to 27. One of the principal addresses will be given on Thursday, September 25, by Walter Goodnow, of Chicago, on "The Horse and Future Outlook."

The carriage trade is said to be in a highly prosperous condition and manufacturers are having great difficulty in filling orders, the chief business coming from the south, where the buggy is as popular as of yore.

Sessions of the convention will last only two hours daily, from 10 a. m. until noon. President A. H. Ahlbrand, Seymour, Ind., will call the convention to order Tuesday morning, September 23. Frederick P. Vose, chairman of the ways and means committee, Chicago Association of Commerce, will make the address of welcome. The response on behalf of the carriage makers will be delivered by former president Philip E. Ebrenz, St. Louis.

Then President Ahlbrand will follow with the opening address, and after that the president for the coming year will be nominated and a committee appointed to recommend other new officers.

The publicity and executive committees will report Wednesday morning, through their respective chairmen, William H. McCurdy, Evansville, Ind., and P. E. Ebrenz, St. Louis. Next on the program is an address on "Accessory Trades," by Homer McDaniel, of Cleveland, O.

The program from Thursday, September 25, the closing day, consists of a report by the committee on statistics, O. B. Bannister, Muncie, Ind., chairman; address by Walter Goodnow on "The Horse and Future Otulook"; report of committee on new members, George W. Huston, Cincinnati, chairman; report of committee on freight and classification, Theodore Luth, Cincinnati, chairman; the hearing of other reports, annual election and choosing of the place for holding the 1920 convention.

The banquet will be held Thursday evening, Sept. 25.

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A consolidation of The Hub and Automotive Engineering

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Vol. LXI SEPTEMBER, 1919 No. 6

Roads and Road Making

IT WOULD seem that the present is not alone an ideal time to build more and better roads but that it is the only time. The need produced by a lack of all road work during the whole war period means that even the normal work of the pre-war period was not done for three or four years, to say nothing of the increase which our fast-growing road traffic should bring. This increase is considerable insofar as motor trucking is concerned. In addition, we have the considerable part of the men in the expeditionary army who would be benefited by a resumption of road work. Hiring these men for this work would be a double benefit; it would give them out-of-doors employment for a considerable portion of what must still be considered as the transition period, and it would put a considerable amount of money into circulation.

Considering all this it is interesting to note what funds are avilable for this work. Our Congress has made $80,000,000 available for road work in 1919, and a total of $275,000,000 up to and including 1921. This money will be available on all or any part of the 2,500,000 miles of rural highway in the country.

In France a fund of $152,000,000, while much smaller than ours, is to be concentrated upon 65,000 miles of national highway, a large part of which has already been improved, the work on less important roads being left to the departments and sub-departments.

The road mileage in England is 150,908 and the government has set aside $50,000,000, while the shires and municipalities will add as much more. Analyzed, these figures show that while France has appropriated over $2,000 a mile, and Britain almost $700 a mile, our tremendous total figures out to but $142 per mile. This means that we are spreading our money out too thin to do any good at all.

To say that we should build less roads and build them better would be the natural conclusion from this, and yet government figures show that England has 2.571 miles of road for every square mile of area, France 1.75 miles, and these United States only .739 miles. On the basis of population, there are 108 French citizens for every mile of road, 239 Englishmen and but 41.81 Americans. Based on these figures we are not building enough roads, for it will take 5,000,000 miles to equal the French ratio of road mileage to area, and 7,500,000 to equal the British ratio.

This leads us back to the fact that we have not built enough roads in the past and must begin and make up for it now. The present appropriations, while seemingly large, are very small when the size and wealth of the whole country are considered, and its total of automobiles and motor trucks. We must build more roads.

What Will Supercharging Avail?

DURING the war some investigations were made into the benefits of supercharging to airplane engines, the idea being to increase the power at high altitudes, not alone to what it would be upon the ground, but to a greater extent. An early rumor relative to the work of Rateau in France was to the effect that the power was increased to such an extent as to double the normal speed of the airplane so equipped, a 150-mile airplane attaining a speed of 300 at very high altitudes.

In our own Bureau of Standards tests no such results were obtained, in fact the maximum gain through supercharging was approximately 2.5 per cent. Of course, the real benefit to the aviator is that his power is maintained almost regardless of his altitude, so that as compared with the usual case with tremendous losses at high altitudes, this represents a great advance.

But when considered as a possibility for application, in the light of present and probable near future demand for small light cars of greater efficiency and economy, there seems to be little in it in its present state. A blower on ball bearings is rotated at speeds in the vicinity of 25,000 r.p.m. to give pressures up to 14 lbs. per sq. in. For automobile work, particularly on small cars, would the added number of parts, the extra weight, the power needed to drive the blower, and the adjustment arrangement or controlling devices, not add more than the increased power, if there was any, would warrant? From present data it would seem that they would, so we must say that whatever supercharging, or superinduction as some prefer to term it, may add to airplane engines at high altitudes, it would add little or nothing worth while to automobile engines.

Responsibilities of the Body Builder

WITH the announcements of the 1920 model motor cars nowadays and the information leaking out about others in preparation, it is apparent that there will be many new features, that the cars really will be different, that chassis designers have taken their responsibilities seriously and have produced something in tune with the times.

The public wants more economical cars, lighter in weight, easier to operate, more simple to care for and adjust and better looking. Each of these items means new work for the body builder, advances in the art to be met and kept abreast of, and other responsibilities. Will the body builder respond to this situation?

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Details of 300-Horsepower Maybach Airplane Engine--III

Mechanical Construction and Design Features of One of the Most Recent and Most Successful German Airplane Motors—Carburetion and Fuel Supply System, Fuel Pump, General and Specific

(Continued from page 233, May issue, Automotive Engineering)

Students of airplane engine design and construction will be interested also in the Liberty 400 horsepower motor description in the February, March and April issues of Automotive Engineering for 1919, in the Mercedes 240 h.p. which appeared in September, 1918, and in the Benz and Mercedes 160 h.p. engines which were described in the December, 1917, issue as well as the Curtiss 12-cylinder and Basse-Salve (German) airplane engines in the May and Duesenberg in this issue.

THESE carbureters are designed to be used in conjunction with a gasoline pump system, and in place of a float chamber employ two small constant-level overflow tanks inside each carbureter. This method obviates the necessity for using pressure release valves in the fuel system. Referring to the sectional drawing of the carbureter, Fig. 26, they are constructed of a cast aluminum water jacketed body, in the center of which is mounted the rotary barrel-type throttle, open on one side to the curved passage to the induction pipe and on the other to the mixing chamber above the jets. The main air supply is taken through a passage cast in the aluminum carbureter body directly below the throttle and the extra air supply is automatically controlled by a guillotine type shutter, which works vertically just in front of the jet control lever. The throttles of both carbureters, together with

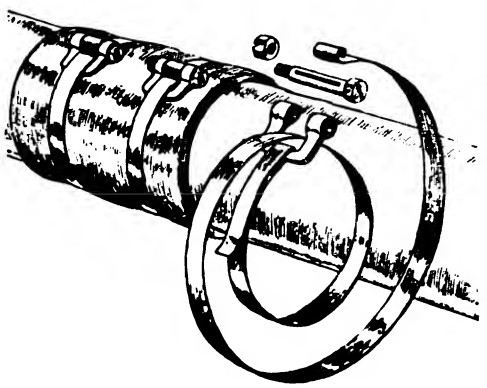

Fig. 24—Ingenious steel band clip used on rubber connections of intake and water pipes

the mechanically controlled jets and the extra air shutters, are all interconnected.

The working principle of the carbureters and the functions of the various parts is more clearly demonstrated in the purely diagrammatic sectional drawing, Fig. 22, which is to a great extent self-explanatory. Fuel is delivered by the pump into a small tank A of each carbureter through a restricting jet B, shown in the diagarm. The fuel in these small tanks or reservoirs is kept at a constant level by means of the overflow pipe C, which leads back to the main gasoline tank, via the small lower tanks D below the jets which are supplied through the pipe E. An air vent F, fitted with a baffle plate, is provided in the top of the constant level tank A, which is also connected to the main fuel tank by a pipe G, leading to a hand fuel pump, or may be plugged and not used, as was the case in the Rumpler biplane.

The main and pilot jets consist of two holes, drilled in the top cover of the lower reservoir D, and are similar in

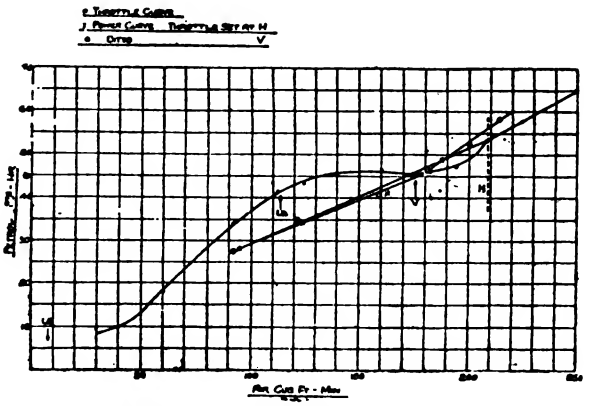

Fig. 25—Diagram of comparative tests of carbureter

principle to the White and Poppet jets. The area of the jet openings is mechanically controlled by means of a small hole drilled eccentrically in the jet cap H, which as previously described is connected by levers to the throttle and air control levers. The function of the top tank A is apparently to deal with the large excess of fuel delivered by the pump at high speeds, while the lower tank which is gravity fed provides a constant fuel level for the jets.

The mixture strength at any point of the throttle curve is governed by purely mechanical means, there being no venturi or special jet arrangement. The jet depression is obtained by restricting the air flow at what approximates to a sharp edged orifice; consequently the loss through the carbureter is very high compared with a carbureter using a venturi tube to get the jet depression.

Contrary to usual practice, the jet depression actually increases on throttling down, the depression being about four times as great at half throttle as at full throttle.

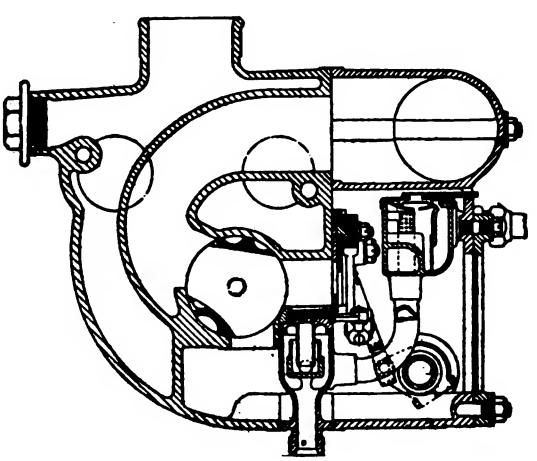

Fig. 23—Sectional drawing of the carbureter

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Control Adjustment

When running slowly, the throttle is slightly open, the supplementary air port closed, and the air shutter practically closed; in this position the small or pilot jet only is open. On opening the throttle the supplementary air port commences to open in conjunction with the throttle

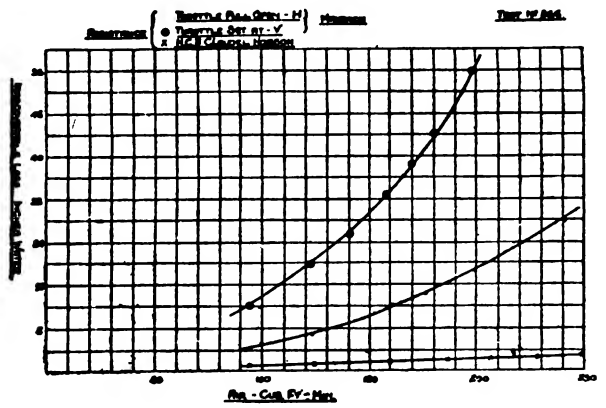

Fig. 27 -Throttle curve diagram from carbureter tests

opening. The main air shutter automatically opens in proportion, admitting more air, which passes directly across the top of the jets, and the jet area increases until the main jet orifice is fully open.

Owing to the interconnection of the control levers, there comes a point when the supplementary air port area opens out of all proportion to the increase in the jet area, the latter reaching a limit with no further increase by reason of the arrangement of the levers. This point represents the opening for maximum power at ground level. If the throttle is opened beyond this point, the air supply rapidly comes out of proportion to the jet opening and fuel supply. By this arrangement a simple form of altitude control is provided.

The various positions for "slow running," "slow speed," "full speed," and "altitude" are marked on the body of the carbureter, and are indicated by a pointer attached to the throttle lever of the rear end carbureter. By means of these markings on the carbureter the correct settings of the throttle lever can be checked when the engine is installed in the machine.

The translation of these markings on the carbureter is as follows:

LE = Leer	= Running Light
LA = Langsam	= Slow Speed
V = Voll	= Full Speed
H = Hohe	= Altitude

The induction pipes are aluminum castings, and are of exceptionaliy neat design, being, as shown in Fig. 23, joined together in one straight pipe. A cast aluminum baffle plate drilled in the center with a 20 mm. hole is provided in the center of the two induction pipes between the front and rear three cylinders. This baffle is evidently fitted to equalize the gas supply to all cylinders.

The design of this equalizing baffle is shown in the perspective sketch, Fig. 23, which also shows the method of joining the ends of the induction pipes by rubber connections and band clips.

Details of the six small primer valves fitted into the top of the induction pipe are shown in the sketch. Fig. 24 clearly shows the construction of the interesting type of band clip which is used for making the connections in the induction pipes, and also for most of the water joints on these engines. These clips are now extensively used on all enemy engines. The method of using these clips is herewith reprinted from the previous report on the 230 h.p. Benz engine.

The clips are made of thin strips of annealed spring steel; these are wound twice round the rubber rings and fastened by small steel links and bolts. In starting to make this joint the end of the steel band is first bent over the bottom bar of the connecting link, and then wound twice round the rubber ring, the free end of the steel band passing through the center portion of the connecting link on the second winding. The end of the steel band is then fastened to the top end of the link by coiling the end several times round the small bolt in the head of the link, the end of the steel band being bent over for about 2 mm., and inserted into a slot cut in the bolt, so that by turning the bolt in the link the steel band is wound tightly round the ring joints, and, owing to the position and shape of the link, remains fixed.

Carbureter Tests

The Maybach carbureter has been tested separately at R.A.E. The results of these tests is shown graphically in the power and throttle curves (Fig. 41), together with a throttle curve diagram in comparison with the H.C.8 Claudel-Hobson carbureter (Fig. 39).

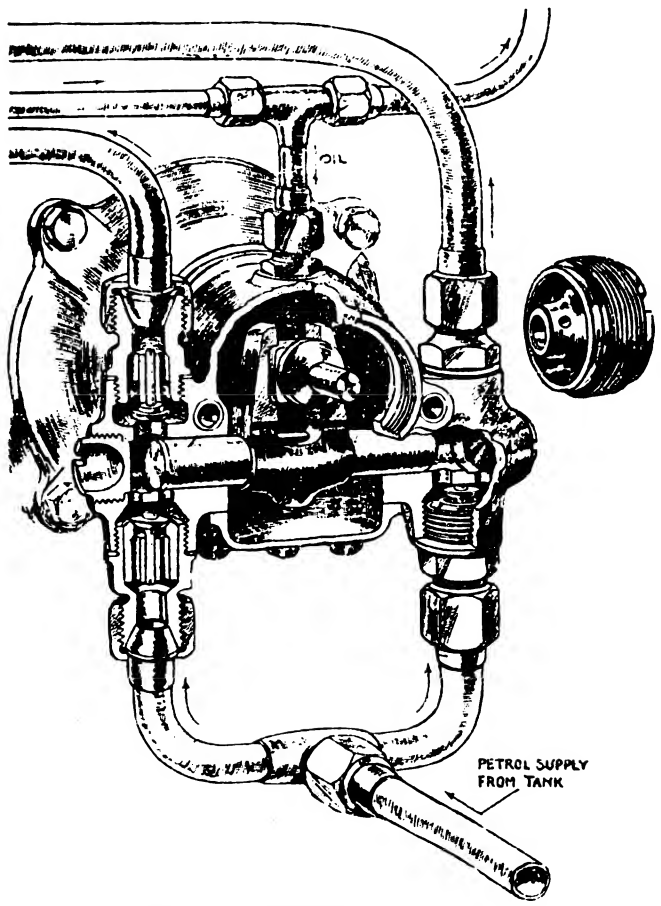

Fig. 28—Sectional sketch of the fuel pump

Characteristic Curves

(a) Throttle Curve—The throttle curve appears good. There is an excess of fuel at first which should give good acceleration, and there is a fair range, down from full throttle, of weak mixture suitable for cruising. Obviously,

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if it is considered desirable to have fuel and air control interconnected, any required throttle curve could be obtained, but it makes an unsatisfactory and complicated arrangement.

(b) Power Curves—The power curves are satisfactory, the mixture being practically constant over a large air speed range.

Resistance Test

The resistance is very high compared with carbureters of ordinary design. For purposes of comparison, the resistance of the H.C.8 Claudel-Hobson carbureter is plotted on the same curve. The two carbureters are for engines of about the same horsepower, and it will be seen that the resistance of the Maybach is about nine times that of the Claudel-Hobson.

Atomization Test

	Air temperature	Air cu. ft. min.	Fuel pts. hr.	Deposit c.c. min.	Deposit per cent of fuel flow
Maybach	58° F.	192	56	23	4 85
H.C.8 Claudel-Hobson	58° F.	195	[illegible]	32	6.62

The atomization of the Maybach is rather better than the Claudel-Hobson, but this is obtained by a high depression and high loss through the carbureter.

Conclusion

The carbureter seems satisfactory on throttle and power curves and atomization, but the resistance is very high and the weight excessive. The throttle curve is obtained by a complicated mechanical system which would need careful first adjustment and constant adjustment for wear. The air is taken through the moving parts, and if any dust is present the mechanism is very liable to stick or to render the control very hard to operate.

Fuel Supply System

Fuel is supplied to the two carbureters by a small double acting duplex fuel pump, which is attached to the rear end of the bottom half of the oil base, and is driven at half engine speed directly off the rear end of the main oil pump spindle, the fuel pump driving shaft being coupled to the oil pump spindle by a dog clutch. The installation of the pump is clearly shown in the general arrangement drawing of the engine, and the details of the supply system are shown in the diagrammatic drawing, Fig. 16.

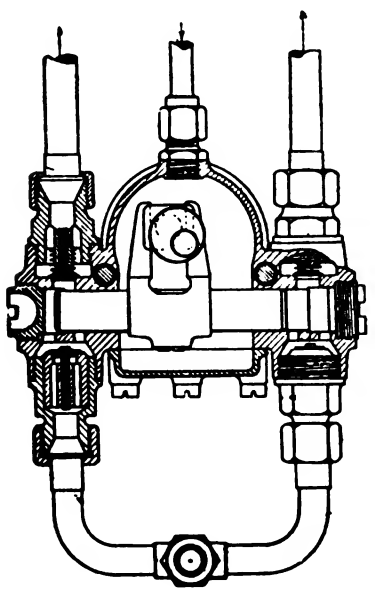

Fig. 28—Arrangement of fuel pump shown in section

Regarding the installation of the fuel supply system to the fuel pump in the machine, it is assumed that the main fuel tank is provided with the ordinary float regulator which has always been fitted inside the fuel tanks for regulating the supply through the fuel pumps; but owing to the fact that the machines from which these new Maybach engines were taken were completely destroyed no information regarding the construction and installation of the fuel tanks is available.

In the Rumpler machines fitted with the 260 h.p. Mercedes engines two fuel tanks are fitted. The main tank is in the center of the fuselage behind the pilot's seat, and the auxiliary tank is situated under the pilot's seat.

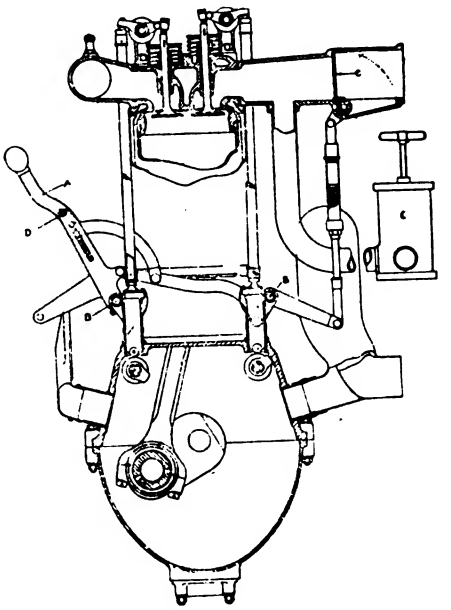

Fig. 30—Diagrammatic section of engine showing components of starting system and functions of each

Fuel Pumps

The design of the compound fuel pump is shown in the sectional drawing, Fig. 29, and also in the sectional perspective sketch, Fig. 28.

The pump consists of two opposed cylinders, in which a reciprocating plunger works, the ends of which operate as single acting pumps. The pump plunger carries a yoke fitted with a sliding bush, which forms the crank-pin bearing of the small pump crankshaft, driven, as already described, off the rear end of the oil pump spindle at half engine speed. The bore of the fuel pump plunger is 15 mm. and the stroke is 17 mm. The outer ends of the pump barrels are as shown, and are fitted with screwed plugs, which form compression chambers.

The small non-return suction valves are situated directly above and below the two compression chambers, and the two fuel delivery valves are fitted above the compression chambers. The valves communicate with the compression chambers through small ports drilled in the pump barrel. Both the suction and delivery valves are of the poppet type, and each delivery valve is spring loaded by means of a small brass wire coil spring.

The valves are supported in guides drilled in the unions which form the valve boxes and to which the fuel delivery pipes from the fuel tanks and to the carbureter are connected. The internal diameter of both these pipes is 10 mm.

It will be noticed that both the suction valves are fed by the same fuel supply pipe as shown in the sketch.

The center portion of the fuel pump body, which is a gun-metal casting, forms a small circular crank chamber for the pump plunger, and is fitted at the bottom with a detachable cover plate which is secured by six set screws. The whole of the pump crank chamber is filled with oil under pressure from the main lubricating system, through

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an oil pipe connected to the center of the pump body casting and leading from the rear end of the detachable main oil lead pipe on the engine. By this means the efficient lubrication of the yoke and sliding bush and also of the seating of the pump plunger is assured.

R. A. F. Tests of Fuel Pumps

Flow tests at three speeds with varying heads were taken; in order to represent working conditions in the engine, flow tests were also taken through jets similar to those employed on the engine.

Delivery Tests

The fuel pump was run at three speeds, viz., 550, 800 and 1,275 r.p.m., and the outlet pipe was connected to the pump against a variable head from zero to 6 lbs. per sq. in.

The maximum and minimum fuel delivery at these speeds and heads are given in the following table:

R.P.M.	Maximum Flow Zero Head	Minimum Flow 6 lbs. Head
550	300 pints per hr.	167 pints per hr.
800	422 pints per hr.	264 pints per hr.
1,275	630 pints per hr.	498 pints per hr.

From curves of these results, not shown, it is evident that the valves are acting well, and that the drop in delivery with increasing head resistance is due to cavitation. The pressure of the oil in the pump case during these tests varied between 15 and 20 lbs. per sq. in., and the leakage of oil and fuel past the end bearings of the pump spindle during one hour's test run was approximately one pint.

Tests Through Engine Delivery Jets

In the engine the fuel is delivered through restricting jets shown in Fig. 22 (see May issue Automotive Engineering) into the constant level tanks, which feed the jet chambers below, and are provided with overflows to the main fuel tank.

In the tests both outlets of the pump were connected by a Y-piece with one delivery pipe, the end of which was closed by a plate 1/16 in. in thickness, having two .07 diam. jet holes drilled through it.

The fuel pump was run at three speeds as in the former tests, and the following results recorded of delivery and head resistance:

R.P.M.	Head Resistance	Pints per Hour
550	4.5	160
800	9.0	218
1,275	25.0	360

Starting Gear

The principle of the Maybach starting gear is now so well known that only a brief description of the mechanism and a few details of the construction will be necessary.

In the semi-diagrammatic cross sectional drawing of the engine, Fig. 30, the working principles of this simple and distinctive starting mechanism are clearly shown. By the depression of the hand lever A on the induction side of the engine, all the tappets are lifted off their cams through the action of small lugs formed on the top of the tappets, which fit into slots cut in the tubular lay shafts BB. All the valves, both inlet and exhaust, are thus opened in the cylinder heads; and at the same time the hand lever A closes the shutter C in the exhaust manifold by the connection of levers shown in the drawing. The valves and exhaust shutter are then locked in this position by a peg, which is inserted in two holes D, which now coincide in the hand lever A.

By the action of a large hand suction pump E in the pilot's seat, gas is then drawn into the combustion chambers through the inlet valves and induction pipe from the carbureters as indicated in the diagram. When the cylinders are charged the valves are returned to their normal positions by the withdrawal of the locking pin in the hand lever A, and simultaneously the free passage in the exhaust manifold is again opened by the shutter C. Ignition is then effected by means of a Bosch hand-starter magneto in the pilot's seat. It will be noticed that the exhaust shutter lever is provided with a spring-loaded tie rod to ensure a true seating for the shutter. In order to prevent the engine from being started until the hand lever has been released to its off position, the locking hole in the lever which takes the pin is made in such a way that only a special form of locking pin can be used. For this purpose the handle of the starting magneto is made easily detachable, and is used for the purpose of locking the hand lever A. It is thus practically impossible to cause ignition with the valves open and the exhaust passage closed, which, of course, would cause firing back into the carbureters, and probably also result in destroying the hand pump.

Calibration and Endurance Tests

The Maybach engine (No. 1261), after several slight repairs had been carried out to the cylinders and propeller hub flange and coupling, was erected on a test bed, coupled to a Heenan and Froude dynamometer, and submitted to the following power and consumption tests, including a one hour's duration test at normal speed. The results of the calibration tests are as follows:

R. P. M.	1,200	1,300	1,400	1,500
B. H. P.	258	279	294.5	304.5
Brake, M. E. P.	120.5	120.3	118	113.9
Fuel consumption in pints/B.H.P. hr.	.53	.52	.526	.545

The results of these tests are shown graphically on the diagram Fig. 32.

One Hour Test

At the conclusion of the above tests a run of one hour's duration at normal revolutions (1,400 r.p.m.) was carried out with the following results: Average b.h.p., 290; fuel consumption, 20 gals. = .55 pint per b.h.p. hour; oil consumption, 11 pints = .038 pint per b.h.p. hour; oil pressure, 5 lbs./sq. in.; oil temperature, 67 deg. C.; water temperature (inlet) 57 deg. C.; water temperature (outlet) 68 deg. C.

Valve Timing During Tests

Inlet O. 8 deg. E., exhaust O. 33 deg. E.; inlet C. 35 deg. L., exhaust C. 7 deg. L.; magneto advance 38 deg. E.

Running was steady at all speeds between 900 and 1,400 r.p.m., but owing to the fact that the propeller hub flange on the crankshaft was damaged, and was running slightly out of true, vibration became excessive above 1,400 r.p.m.

Considerable trouble was experienced with the water connection between the cylinders on the exhaust side. The running became unsteady below 900 r.p.m.

Distribution

Owing to the exhaust manifold being fitted as part of the engine starting gear, it was not possible to form an idea of the distribution.

A diagram of the inlet and exhaust valve lift is shown graphically in Fig. 31.

Readers who have missed the earlier parts of this extensive technical description can obtain the two earlier parts and the issues in which they appeared upon application.

The technical tables which accompany the preceding and complete the description will appear in October issue.

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Oxy-Acetylene Welding Methods

If one considers the matter a little he will perhaps have no difficulty in seeing that heat applied at one part of a piece of work will cause movements of other parts, which may be more or less distant. Thus, suppose one heats a strip of metal at the central spot on one face. The effect is a tendency to lengthen the face that is heated. The ends of the strip will move. In fact, there will be a bending effect, the hot spot being on the outside of the bend. Distortion of the work may result from local heating, if one is not alert. Moreover, it is possible sometimes to use the disturbing effect to counteract certain swelling and contracting effects due to local heating and local cooling.

For example, suppose one has a casting with a crack in the body. The crack is chiseled out to form a canyon-like depression. Here the new metal is to be added. But note this. The metal put into the groove or depression is at the melting temperature. And a little of the metal on the sides of the groove may also be at the same heat during the filling operation. Aside from this, however, there will be a great amount of metal, relatively, all around the crack, which never gets anywhere near the melting point.

The contraction of the metal which surrounds the crack will, in general, be very much less than the contraction of the metal filled into the crack. That is, this would be the case if one did not forestall the matter. Thus, by heating the ends of the crack prior to beginning any filling operation one may often cause the crack to open in the part between the ends where no especial amount of heat is in action. In short, by resorting to this prior heating of the ends of the crack, one produces an enlarged opening. Filling this with molten metal, one secures an advantage. For the crack draws together upon being relieved by cooling at the ends and tends to keep pace with the shrinking of the weld. If the crack runs from the rim toward the interior one may proceed similarly and often succeed in opening the crack an artificial distance.

Sometimes the crack or break is so situated in the interior of the work of certain shapes that any considerable local heating at the crack and the filling with new metal would ultimately result in throwing a big strain on one or more outlying parts. The strain producing damage might be due more to contraction than to expansion. That is, the break, if one occurs, may very well take place during cooling. Thus, suppose the casting consists of an annular ring with a diametral piece stretching from one side of the ring to the other. If such a casting in one piece should be broken in the diametral part, the effects of welding at the break would be to throw a stress on one rim. Such a stress might easily result in one or more fractures.

It is, accordingly, often better to anticipate the fracture or fractures and cut one, or two if necessary, in the rim before beginning. The advantage of cutting the rim is that then we know the full result (how many rim breaks there are) and have placed them to the best advantage. After the inner crack is welded, the openings on the rim may be dealt with. Similarly, where one has a break in a spoke of a wheel, the whole being a casting, it may be necessary to foresee strains on the rim and provide against undesirable and badly located breaks by making suitable cuts at points of one's own selection, as shown in Fig. 1.

One authority (Manly) suggests that certain cases may be dealt with by the use of jacks or wedges to force the interior crack open. I give a modification of his illustration of a form where such devices might be suitable if the material will permit (see Fig. 2). Here the break to be repaired is located in a short cross-piece connecting two long arms held rigidly by a cross-piece at one end but left unsecured at the other. If in this case no attention be paid to take care of the disturbance arising from the local operations at the crack, some such result as the following is to be expected:

The filling in of a groove made at the crack would be followed by contractions in the weld from the melting point to normal. Either the weld would separate from one or both sides of the groove, or the long arms would be drawn closer together than they were originally. Distortion or a break somewhere would then result. However, the effects of the contraction may be anticipated by forcing the free ends of the arms somewhat apart, using a pair of wedges or the equivalent for the purpose. This would open the crevice, thus permitting an increased amount of filling material to be put in. The weld would then not contract to so thin a plug of metal as before.

Where a considerable casting is involved, the welder will

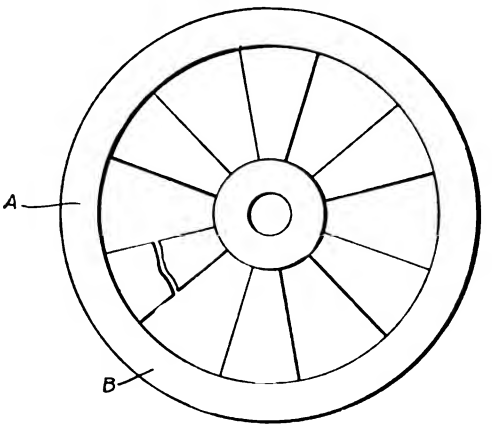

Fig. 1—The wheel may be cut at A and B and welded later

do well to consider in advance just what the results of heating, filling with molten metal and subsequent cooling, will be. He may be able to provide against trouble and succeed by very simple means in effecting a very important repair.

Blow Holes and Other Cavities

The oxy-acetylene process is exceedingly useful in filling in cavities due to the original casting process or to some subsequent breakage. Thus it performs a service in reclaiming a new but defective casting and also in repairing an old one. Whether the casting is new or old makes no difference to the torch, provided the surface of the cavity everywhere shows sound metal perfectly clean. In old work, and perhaps in new, it will often be the proper thing to chip with a chisel or similar tool all over the inside surface to make sure that absolutely clean, uncontaminated metal is to receive the new material that is to be added.

After the cavity has in some thoroughgoing, satisfactory manner been cleaned, the filling is begun first by melting metal of the work at the bottom of the cavity. New metal melted from a rod may now be added. But it is advisable to remember here as well where a plain weld is being made that the rule to be observed is to add molten metal

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to molten metal. This rule will require ultimately that the entire inner surface of the cavity shall be gone over by the torch until the melting point is reached.

Further, the rule applies to cases where new metal is to be added to new. If a part of the new material, already in place, cools below the melting point, it is the proper thing to remelt it at the moment before other new metal is added from the rod. By a careful observance of the two rules—one as to chipping and the other as to adding molten metal to molten metal—a cavity can be filled to excellent advantage.

The importance of cavity filling by the oxy-acetylene process is very great indeed. It is the remedy for many castings nearly perfect but still possessing blow holes. It is often the remedy when in repair work after putting the various parts of a broken casting together it is discovered that a gap still remains. Further, upon putting a casting under a planer or in a lathe, it may be discovered after the machining has gone on for a space, that the cuts

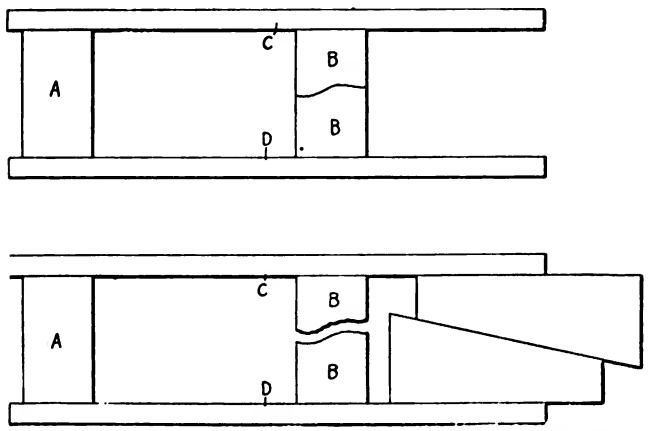

Fig. 2—How the casting may be sprung by wedges for welding

are opening up unknown but ugly holes. The oxyacetylene torch affords a fine remedy for this situation.

The Filling Material

The filling matereial to use will vary with the casting and the circumstances. In general, whatever is suited to a plain weld will be suited to a cavity. That is, if the casting is gray cast iron, a pure iron, such as Norway iron, will often be suitable. However, there will be a film of metal belonging to the casting itself which has undergone melting. This film is, of course, where the new and the old metals join.

Now, the high temperature of the torch may have burnt out a good deal of silicon and the gray cast iron may have been converted into white iron. Such a film may interfere with machining or it may not. If it does, then instead of filling the hole up with Norway iron, one may use bars of gray cast iron containing an excess amount of silicon, with the purpose of offsetting the prospective silicon loss. If the casting is of steel the cavity may be properly filled with the same cast material. At a pinch Norway iron or an American equivalent may be used.

Adding New Parts

Sometimes a knob or a lug or a gear tooth may be partly or wholly gone. Here the oxyacetylene torch is often able to supply the loss. That is to say, a new part may be built up in the rough by melting off material from the welding rod and afterwards finished to shape by means of hand or power-driven tools. Thus, a tooth of a cast gear may be entirely gone. Under old-time conditions the gear would go out of service. But this is not always the case today.

When building up a gear tooth by means of the gas torch, the first thing is to make sure that the fractured surface on the rim of the gear is absolutely clean. Chipping may advantageously be used here. Or the file may be possible. After exposing fresh material it is heated to the melting point, spot by spot, and new molten metal added. The tooth may be built up pretty much as a weld is effected.

Sometimes the part to be added will be so considerable in size that it may seem better to cast it as a separate casting and then add it to the main casting, using the gas welding procedure to effect the union.

But even here the torch may, at times, be advantageously employed in making the small casting itself. A principal matter will be the mold. The workman will judge whether it will be more suitable to use a sand mold or a cast iron one. In either case the metal to fill the mold will be supplied by the torch operating on welding rod. Naturally, only such castings may be made in this way as those which may be built up little by little.

When adding an old or a new part, not building up, but by joining a little casting to a big one, it will be well to remember that the joint will shrink upon cooling. If one has a lug or knob to unite to the main casting, it will be well to arrange matters so that it projects at the beginning of operations further than is wanted at the end. In other words, allow for shrinkage at the joint.

Where a part is to be built by small additions from the rod it will be well to bear in mind any subsequent chiseling, filing, scraping or the like that will need to be performed. White iron is very hard and will not respond so well to tools. So then if the main casting is of gray iron, the rod should be of material that can readily be cut after the rough part has been built up and has cooled off. Similarly with a main casting of steel. However, it is not always necessary to do all the finishing on cold metals.

Naturally, an intelligent user of the torch may, after learning the main lines that have to be followed, very well be able to make variations and applications not fully covered in the foregoing.—J. F. Springer, in Automobile Dealer and Repairer.

Annual Salon in November

The entire second floor of the Hotel Commodore, New York City, will be utilized for the Annual Automobile Salon the week of November 16-23.

The European lines to be shown are announced as the De Dion Bouton, the Peugeot and the Renault, by French makers; the Rolls-Royce, the Siddeley-Armstrong and the Sunbeam, by English factories, and the Lancia and, possibly, the Fiat, by Italian makers.

American exhibitors, so far announced, are the Brewster, Cunningham, Daniels, Locomobile, Meteor, Phianna and Porter lines. Body builders to exhibit are the Ostruk, Fleetwood, Holbrook and Rubay companies. Several accessory makers also will show.

The officers of the show are E. Lascaris, De Dion Bouton representative here, president; T. E. Adams, Lancia representative, vice-president; Leon Rubay, of the Rubay Co., Cleveland, vice-president, and R. W. Schuett, Rolls-Royce representative, secretary and treasurer.

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Helpful Hints for Designers and Draftsmen

Beneficial Effects of Zirconium in Steel

The desire of automotive engineers for steel and other metals which possess at the same time the maximum strength, the lightest weight and easy machining qualities, has led to the use of many alloys. Among those which have not been widely tried but which have shown much promise is zirconium in the form of ferro-zirconium, this having proven very advantageous when added to armor plate and projectile steels.

The following valuable information regarding the effect of zirconium in certain alloy steels is translated from a brief article appearing in Le Genie Civil:

Zirconium and its alloys, added to molten steel, dissolve completely. The ferrozirconiums thus obtained possess an unusual degree of strength which has made them useful during the war for the manufacture of armor or any form of sheet metal for defensive purposes. Steel armor made of nickel-zirconium steel, having a thickness of 10 mm. (0.39 in.) has exhibited the same resistance to the perforating bullet of the Germans as nickel-molybdenum steel of 13 mm. (0.51 in.) thickness of chromium steels of 16 mm. (0.63 in.) thickness.

The zirconium steel which has given the best results as far as firing is concerned has the following composition and physical properties:

Carbon	0.42 per cent
Manganese	1.00 per cent
Silicon	1.50 per cent
Nickel	3.00 per cent
Zirconium	0.34 per cent
Tensile strength	198 kg. per sq. mm. (281,560 lbs. per sq. in.)
Elastic limit	169 kg. per sq. mm (240,320 lbs. per sq. in.)
Brinell hardness	470 (weight of ball 10 kg., making an impression of 2.8 mm.)

In an article published by the Bulletin de la Societe d'Encouragement, January-February issue, M. Garcon indicates the process involved in making ferrozirconium and gives the details as to the casting, rolling and heat treatment of armor containing the alloy.

Investigations are actually being made with reference to a new application of ferrozirconium in the manufacture of high speed tools. The author concludes his article with the details to be observed and the precautions to be used in the use of zirconium.

In the earlier portion of the extract referred to the statement is made that zirconium combines easily with the metalloids but it is necessary that the temperature be very high. Even then there is great difficulty in obtaining the element in the metallic state.

Diagram of Diameters and Speeds

It is frequently necessary to know the surface speed of a member when the diameter and rotating speed are known, or when the surface speed and rotations are limited, to determine the best diameter. While the computations in this problem are not unusually involved, they are long and subject to error, so that the chart herewith will save both time and trouble.

This shows, as a plotted chart, the diameters along the vertical axis and the surface speeds in feet per minute along the horizontal, the curves representing the resulting rotative speed in r.p.m. It can be used in three ways, knowing the diameter and r.p.m. to find the surface speed, knowing the diameter and surface speed to find the r.p.m., or knowing the r.p.m. and surface speed to determine the diameter.

It is very simply used, as an ordinary example will show; simply come down or over from the known quantities until they intersect on one of the curves. According to what is known, this either gives the desired result or it is found from this by following the horizontal or vertical line to the margin. Thus take a piece 3 in. in diameter and follow the horizontal line representing 3 in. across to the right. If the rotative speed of this is 175 r.p.m., the intersection of this horizontal with the curve for 175 r.p.m. will give the surface speed, at the dotted vertical, which followed to the upper margin shows 137 ft. p.m. Or if the r.p.m. had not been known but the rotative speed instead, the process would have been the same, following the horizontal and vertical lines until they intersected, this point of intersection representing the rotative speed. If it were not on a curve, interpolation would determine it with sufficient accuracy. In this interpolation it should be remembered to compute according to the distances to the curves on either side of the point along a line, at right angles to these curves and not in either a vertical or horizontal direction.

Effect of Sulphur on Brass Castings

The presence of sulphur in brass castings appears to

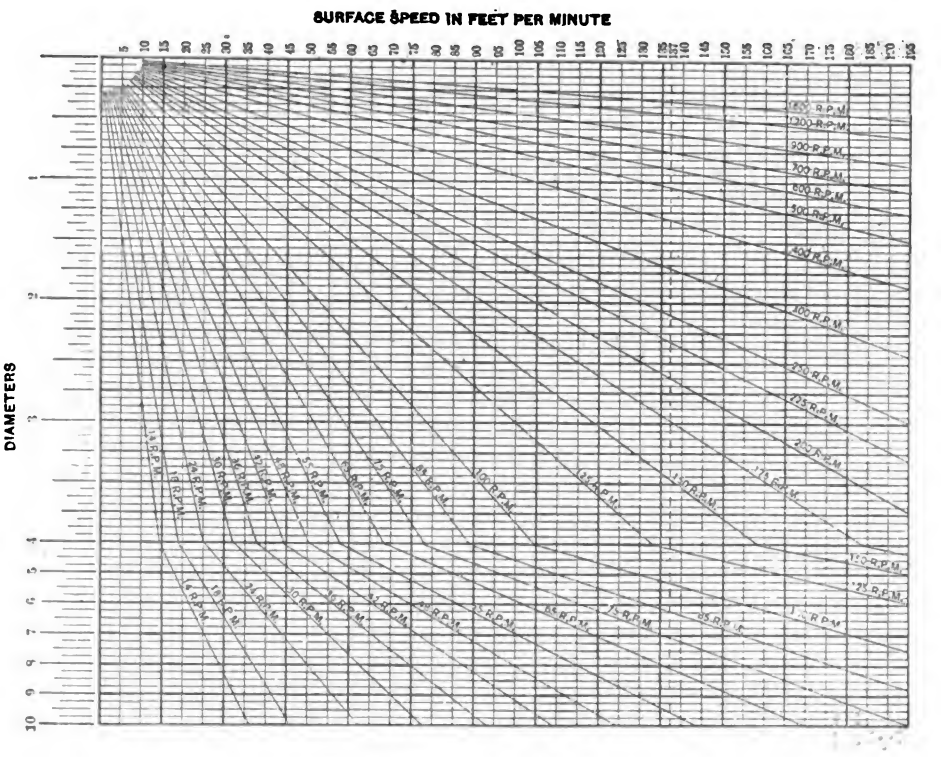

Fig. 1—Chart giving diameters, rotative and surface speeds

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result in dirty metal, blowholes and dark skin on the surface. In the opinion of one authority many failures that are credited to the presence of oxygen are really due to sulphur. It is stated that in the most careful crucible melting in coke-fired furnaces, the metal will take up from 0.02 to 0.05 per cent of sulphur. Copper has the greatest affinity for sulphur of the foundry's metals, apart from manganese, and it tends to absorb it if brought in contact with sulphur-laden gases. Sulphur in such case would accumulate each time the metal is melted, and accounts for the dark skin on re-run castings, as compared with those of first-melt metal. The claim that scrap is not as good as new metal may have a direct connection with the sulphur content, as much of the scrap on the market has been melted over many times. A further effect of sulphur is to make the castings "redshort" and liable to crack in the mold.

Comparison of Money Standards

The widespread talk about exporting and thoughts on the subject of exporting goods lead naturally to a consideration of the weights and measures of the countries into which the exporting is to be done, as well as the money standards of these countries, expressed in ordinary commercial units. In the table below the figures are all based upon pre-war figures, of course, but it should be borne in mind in using these that the various exchange rates have been changed, in the case of the Central Powers radically changed, while some of the others are still fluctuating. In any case knowing the present rate of exchange, it is a simple matter to figure out the ratio of this to the normal pre-war figure which the top of this table gives and then apply this ratio as a simple decimal multiplier to all the others given in the latter part of the table.

Thus on September 17, francs (cables) were quoted in New York at $9.03 instead of the table figure of $5.18. This gives a multiplier of 1.74 or as much easier to use and practically as accurate considering the wide fluctuations, 1¾. Then using francs, multiply all the quantities, francs per kilogram, etc., given in the table by 1¾.

	Dollars	Marks	Florin	Franc	Shilling
$1.00	1.00	4.20	2.46	5.18	4.12
Mk. 1.00	0.238	1.00	0.586	1.23	0.979
Fl. 1.00	0.406	1.71	1.00	2.10	1.67
Fr. 1.00	0.193	0.81	0.475	1.00	0.794
Sh. 1.00	0.243	1.021	0.599	1.26	1.00

$1.00 per lb. Avoirdupois	= 9.24 marks per kilogram.
	= 5.41 florins per kilogram.
	= 11.40 francs per kilogram.
	= 9s. 0d. 3 far. per kilogram.
1 sh. per lb. Avoirdupois	= 2.25 marks per kilogram.
	= 1.32 florins per kilogram.
	= 2.77 francs per kilogram.
	= 0.535 dollars per kilogram.
$1.00 per yard	= 4.59 marks per meter.
	= 2.69 florins per meter.
	= 5.66 francs per meter.
	= 4s. 6d. per meter.
1 shilling per yard	= 1.11 marks per meter.
	= 0.66 florins per meter.
	= 1.38 francs per meter.
	= 0.266 dollars per meter.
1 U. S. gallon	= 3.79 liters = 0.833 British gallons.
1 British gallon	= 4.52 liters = 1.2 U. S. gal.
1 Kilogram	= 2.2 lbs. avoirdupois.
1 Pound Avoirdupois	= 0.453 kilogram.
1 German Centner	= 1.102 U. S. cwt. = 0.9843 English cwt.
1 U. S. cwt.	= 0.885 English cwt. = 45.36 kilogram = 0.904 German centner.
1 English cwt.	= 1.12 U. S. cwt. = 50.8 kilogram = 1.016 German centner.
$1.00 per U. S. gallon	= 1.11 marks per liter.
	= 0.65 florins per liter.
	= 1.37 francs per liter.
	= 1s. 1d. 1 far. per liter.
1 sh. per British gallon	= 0.226 marks per liter.
	= 0.133 florins per liter.
	= 0.279 francs per liter.
	= 0.054 dollars per liter.
$1.00 per U. S. cwt.	= 4.63 marks per German centner.
	= 2.71 florins per German centner.
	= 5.71 francs per German centner.
	= 4s. 6d. 2 far. per German centner.
1 sh. per English cwt.	= 1.00 marks per German centner.
	= 0.59 florins per German centner.
	= 1.24 francs per German centner.
	= 0.24 dollars per German centner.

Suggestions in Welding Cutting Tools

It has been discovered in connection with welding experiments that it is practicable to weld high-speed tool-steel bits to common cold rolled steel shanks for lathe and planer tools, drills, reamers, etc., with very satisfactory results.

Electric welding high-carbon to low-carbon steel is not a difficult operation, although a little care should be exercised, as a slightly different condition exists than where materials of the same analysis are employed.

Experiments have demonstrated that best results are obtained if the thickness of tool steel is from one-quarter to one-third the total thickness of tool at the weld. Where two pieces of the same kind of steel are spot welded together they heat evenly; but care must be taken in welding high-speed steel to common steel, the former heating more quickly owing to its offering greater resistance to electric current.

The high-speed steel should be thinner in order to generate greater heat at the junction of the pieces. As the copper points used in making these welds are subject to very extreme heat and pressure, they will last longer and do better work if cooled by a stream of water passing through them while in use.

When both metals have reached a welding heat the current is cut off and pressure applied forcing them together. It is not necessary to use any flux in welding, but it is sometimes advisable to apply a solution of borax water, which has a tendency to improve the weld.

If it is desired to temper the tool at the same time it is being welded it should be plunged while white hot into a bath of good hardening oil. When welding a large tool bit to a shank it is advisable to corrugate the welding seats in a perpendicular direction and keep them free from oil, dirt or rust.

After the butt weld has been made the stock must immediately be heat treated or annealed in order to keep the high-speed steel from checking or breaking.—C. A. Hart, in the American Machinist.

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The New and Unusual in the Automotive Field

Winton Stationary Generating Sets for Yachts, Motorboats, Houseboats, Country and Suburban Estates, Country Clubs, etc.

It will be the policy of Automotive Manufacturer (as in Automotive Engineering) to present on these pages each month some car, truck, aeroplane, boat, tractor, engine or other unit, which presents unusual and decidedly different engineering features

Winton Generating Sets

In recent years there has been a considerable demand for small generating sets which could be transported readily and which would produce small quantities of electricity at a modest cost. In the Winton set designed to meet this need, and shown in the accompanying illustrations, a small block motor of extreme compactness is direct coupled to an equally compact generator, the motor having all the general characteristics of an automobile engine of somewhat similar general dimensions.

The demand for this type of equipment comes from private homes and estates, country clubs and the like located beyond the reach of the public service companies supplying current, and for such uses as on houseboats, sailing yachts, motorboats, motor ships and other vessels. The latter, in fact the former also, are owned and used by people accustomed to gasoline motors in their motor cars, boats and elsewhere, so it is but natural for them to turn to the automobile type of power plant for their lighting equipment. Besides this matter of mechanical familiarity, this type is the only one that possesses the qualities of compactness, light weight, ability to operate regularly and continuously on commercial motor car fuel, and with the minimum amount of attention.

In general the sets differ only in the matter of application to the supply of water. Where running water is available no radiator is furnished, the cooling water being taken directly from the source of supply into the water jackets, and from the outlet is allowed to run off into the sewer. Where no running water is available, a good sized tubular radiator is furnished, piped up in the usual motor car method, as well as a water pump and a multiple blade fan, located back of the radiator and driven by belt from the crankshaft, this being housed in by a radiator shroud

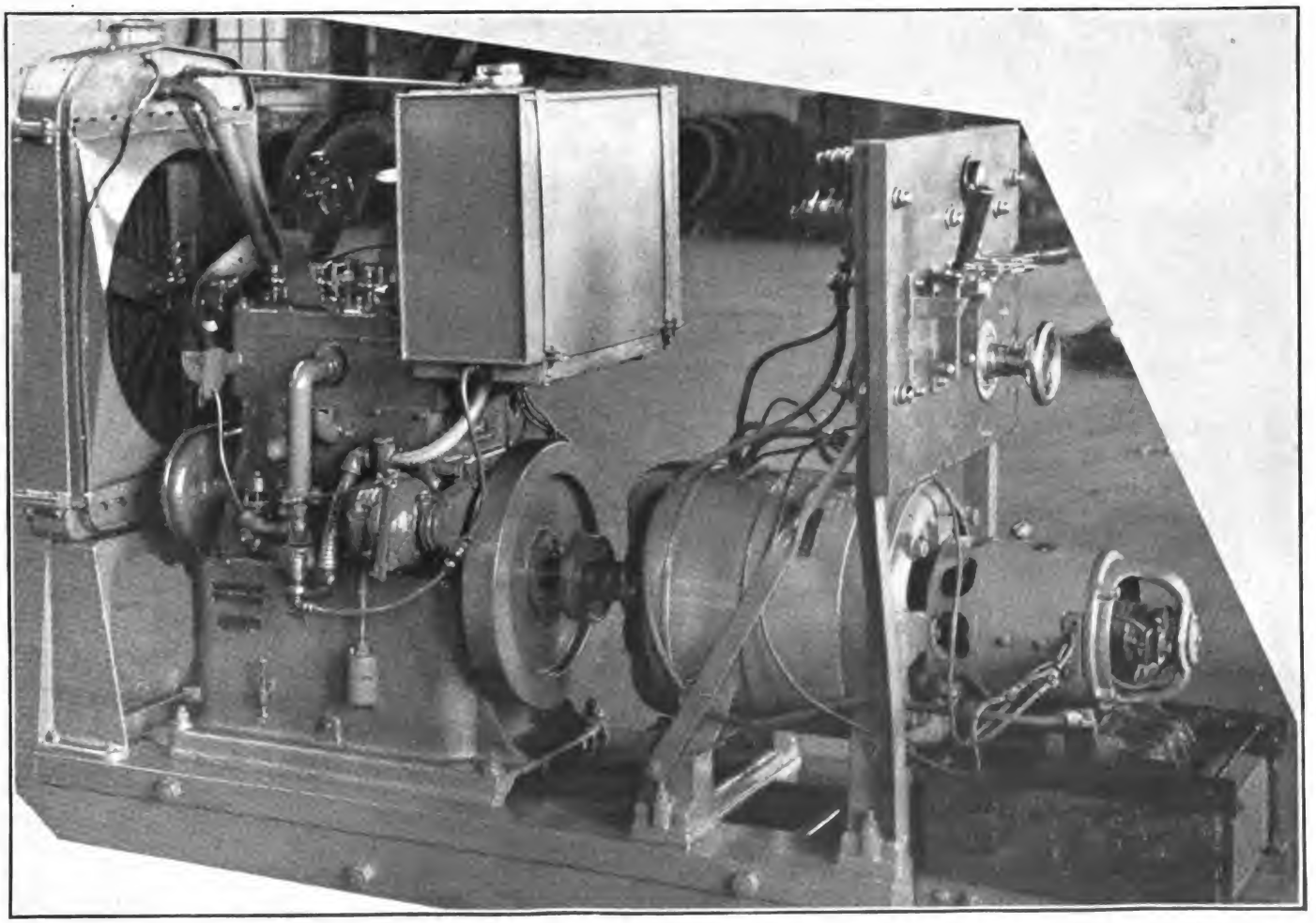

Fig. 1—Enlarged view of the self-contained Winton generating set, showing disposition of the various units, and clean engine design, inlet side

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to obtain the full draft of the fan through the radiator.

The four-cylinder motor has a bore of 3 in. and a stroke of 4 in., and is designed to run at 1,200 r.p.m. It is direct connected to a multi-polar direct current generator of 5 kw. capacity at this speed. The set is designed for indefinite continuous operation at this speed and output and will stand 25 per cent overload for two hours. This current is sufficient to light 250 20-watt lamps or 200 25-watt lamps or 100 50-watt lamps.

As shown in both figures, the cylinders are cast en bloc, this being of special gray iron. The cylinders are of the T-head type with inlet valves on the left side and exhausts on the right, looking toward the radiator. The cylinder casting also forms the upper half of the crankcase and supports the crankshaft. The latter is drop forged, and because of the compactness of the cylinder unit, has but two bearings. These are of bronze. The shaft is ground all over and the flywheel flange is forged integral.

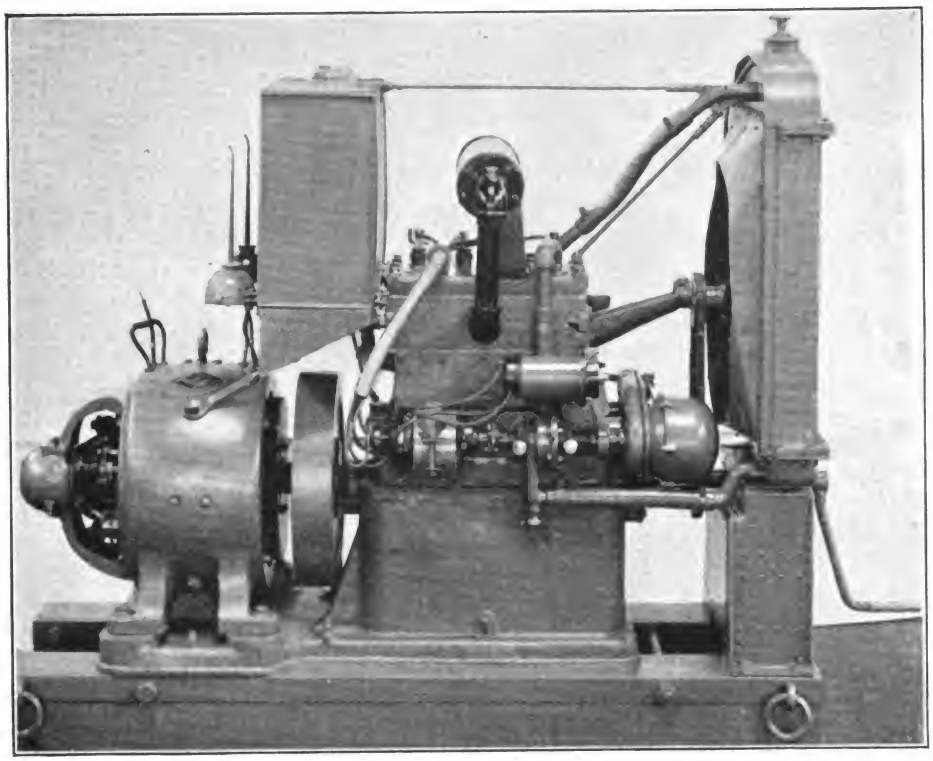

Fig. 2—Full side view of the Winton GL 5 generating set, with radiator fan and water pump. Exhaust and magneto side

The lower part of the crankcase or engine base is a large box-shaped casting with which the generator support is formed integral. The engine portion of it carries the oil supply or reservoir for the lubricating system. The split is along the center line of the crankshaft.

Pistons are of cast iron, fitted with three rings of the simple concentric type. The piston pins are of steel, hardened and ground all over. They are clamped in the connecting rods and turn in the piston bosses. The rods of drop-forged steel have detachable bearings on the crankshaft end, the caps being held by two bolts each.

The camshafts are operated by helical gears, which are inclosed in the gear case at the front end of the engine and run in oil, making a very silent engine. The cams are steel forgings, made separately and pinned in place, after they have been hardened and ground.

Removable plates on the sides of the engine give it a neat simple appearance, and when removed give access to the valve parts. The valves have nickel steel heads and cold rolled steel stems. Push rods are adjustable and work in removable cast iron bearings.

Carburetion is by means of a single jet, raised needle type of carbureter, placed on the left side with a short direct lead from the square fuel tank above. The intake manifold is equally short, straight and simple. A single easily reached lever controls the carbureter action, the same movement which operates the air valve controlling the needle valve.

Ignition is by magneto placed on the right side toward the rear, while the four spark plugs are located vertically in the cylinder head. Speed regulation is by governor of the flyball type, mounted near the carbureter and connected to the throttle valve. A dash pot, suitably interconnected, prevents "hunting."

The generator is direct connected, using an extension of the engine base, so that it forms an integral part of the set. It is a four-pole machine with four commutating poles designed to operate at 115 volts. The no-load voltage is 115 volts, and the generator is compounded for 115 volts at full load allowing for a drop in speed of 5 per cent. The magnet frame is a one-piece steel casting, bolted to an extension of the engine base. The cores are sheet iron laminations, bolted to the generator frame, as are the commutating poles of machine steel. The armature core is of sheet steel laminations mounted on a spider pressed on the shaft, ducts through this providing ventilation.

The weight of the GLX 5 unit, which is intended for use wherever a stationary foundation and a source of running water are available, and which consequently has no radiator, fan, belt, or water pump, is 900 lbs. The GL 5 unit, which is the portable set carrying its own water supply and means for circulating it, that is, fully self-contained, weighs 1,500 lbs.

General Specifications and Details, Winton Generating Sets

Capacity—Set consists of vertical four-cylinder four-cycle gasoline engine, 3 in. bore, 4 in. stroke, direct connected to multi-polar direct current generator 5 kw. capacity operating at 1,200 r.p.m. Set is capable of being operated indefinitely at rated load and at 25 per cent overload for two hours. Complete set includes gasoline tank, muffler and set of tools.

Base—Base of engine is integral casting with generator support and forms crankcase and oil reservoir for lubricating system.

Cylinders—Four cylinders cast in block of special gray iron. T-head type with valves on opposite sides. Casting forms upper half of crankcase and supports crankshaft.

Cylinder Head—Cast in one piece, detachable from cylinder block and secured by cap screws. Water jackets arranged to prevent steam pockets and hot spots.

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Crankshaft—Drop forged, supported in two bronze bushings. Shaft is ground at all bearing points and fitted with integrally forged flange for bolting flywheel to shaft.

Pistons—Cast iron of special mixture and fitted with three concentric rings.

Piston Pins—Steel, hardened and ground; clamped in rod and turn in piston.

Connecting Rod—Drop forged steel, fitted with detachable bearing on crank pin end, secured by two bolts.

Bearings—Wrist pin has bearings in piston; crank pin and crankshaft bearings made of bronze in two halves.

Camshaft—Engine is fitted with two camshafts, one for intake valves and other for exhaust valves. Operated through helical gears driven from crankshaft. Gears run in oil bath. Cams are steel forgings, hardened and ground, carefully adjusted and pinned in place.

Valves—Enclosed within cylinder housing, accessible through removable plates. Nickel steel heads—C. R. S. stem—valve push rods adjustable and operate in cast iron bearings.

Carbureter—Model "R" Schebler carbureter used is single jet, raised needle type of carbureter, automatic in action. Air valve controls lift of needle and automatically proportions gasoline and air at all speeds. Carbureter has eccentric operated by lever conveniently located, which acts on needle valve and insures easy starting.

Ignition System—Ignition is by magneto.

Speed Regulation—Governor flyball type is mounted near carbureter, is connected to throttle valve. Dash pot is interconnected through suitable linkage to governor control lever and prevents "hunting" of governor.

Lubricating System—Oil for lubricating purposes is carried in bottom of crankcase. Sight gage on right side of crankcase indicates oil level. Oil is circulated by plunger pump located at front of crankcase and driven through eccentric on front end of crankshaft. Oil is drawn through screen from lower crankcase to oil line manifold from which oil lines distribute oil under pressure to different parts requiring it. Oil ducts are provided in crankshaft. Ducts deliver oil under pressure from crankshaft bearings to crank pins. Cylinders, cam rollers and camshaft bearings supplied with oil thrown by connecting rods. Sight feed oil gage indicates proper working of lubricating system.

Cooling System—Circulation secured by water pump mounted on left side of engine.

Radiator—Tubular type of ample capacity to maintain uniform temperature without overheating.

Fan—Multiple blade, mounted back of radiator and driven by belt from pulley on crankshaft. Eccentric provides for adjustment of belt tension.

No radiator or fan required on marine equipment.

Generator—Generator is four-pole 115 volt machine with four commutating poles, designed to operate at 115 volts. No-load voltage is 115 volts and generator is compounded for 115 volts at full load, allowing for drop in speed of 5 per cent. Other voltages furnished on request.

Construction—Magnet frame is of cast steel in one piece, bolted to extension of engine base. Magnet cores are sheet iron laminations bolted to generator frame. Commutating poles are of machine steel also bolted to frame. Armature core consists of sheet steel laminations mounted on spider pressed on shaft. Ducts through armature core provide ample ventilation.

Switchboard and Batteries—These are special, varied in each installation to meet the individual requirements of the buyer.

Electrical Capacity—5,000 watts, equal to 250 20-volt lamps, 200 25-volt, 100 50-volt, or other combinations.

Stengel & Rothschild, Newark, N. J., tanners of auto leathers, have filed plans for the construction of a one-story addititon to the boiler plant at its works, to cost about $16,000.

Minors Must Learn English

A bill has recently been passed by the South Dakota legislature providing for the compulsory education of persons between the ages of 16 and 21 years, inclusive, who do not speak, read, and write the English language, until they have reached the educational status equivalent to the fifth grade of the public schools.

The bill provides for the establishment and maintenance of evening school classes and makes the state sheriff ex officio truant officer. The pupils for whom this legislation was created are to attend school for at least eight hours each week during the entire time that such classes are in session within five miles of their residences.

Determination as to the persons who are subject to these provisions is to be made by the county superintendent of schools or some other authorized person. A fine is to be inflicted for vilation of the law, and an appropriation of $15,000 is authorized for the evening classes and the enforcement of the law. Any person more than 21 years and under 50 years of age may attend the evening classes free of charge if he can not speak, read, or write the English language.

Auto Associations to Fight Car Stealing

Concerted action directed toward the abatement of automobile stealing and the improvement of highways will be taken by the national associations representing owners, dealers and manufacturers as the result of a conference held September 9 at the offices of the National Automobile Chamber of Commerce in New York City.

To curb car stealing they will ask for legislation in all states to protect car users and will urge that the Dyer Bill be passed by Congress making it a felony to take a stolen car from one state to another, punishable by imprisonment of not less than two years nor more than ten. In the direction of obtaining better roads they will endorse the Townsend Bill and encourage everywhere permanent types of highways for motor vehicle use.

Another bill that will have their support will be the Volstead Bill, a prohibition measure which, through the efforts of the National Automobile Dealers' Association, has been amended so as to protect dealers who hold mortgages on automobiles confiscated for carrying liquor.

Automobiles at Electric Show

Several displays by leading manufacturers of electric automobiles will be featured at the New York Electrical Exposition to be held September 24 to October 3 in the Grand Central.

Passenger cars will be exhibited by the Baker R & L New York Corp. and Metropolitan Electric Automobile Co.

Johnson Heads Detroit School for Auto Building

Prof. Andrew F. Johnson, who for so many years headed the Technical School for Carriage and Automobile Draftsmen and Mechanics in New York City, has located in Detroit, where he will have charge of a department in the public schools of that city for automobile building and drafting.

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Moving Van and Passenger Body

Never in the history of the country has there been so much unrest among the laboring people. This unrest has led to strikes and the strikes have added to the cost of products and in fact all commodities. Many of the trolley lines in the smaller towns have been forced to suspend operation for days and sometimes weeks at a time. In some cases the trolley companies have gone bankrupt and the tracks are no longer in use.

This condition has greatly inconvenienced the people living along the lines, particularly in the morning and at night when they travel to and from their work in the various villages adjacent.

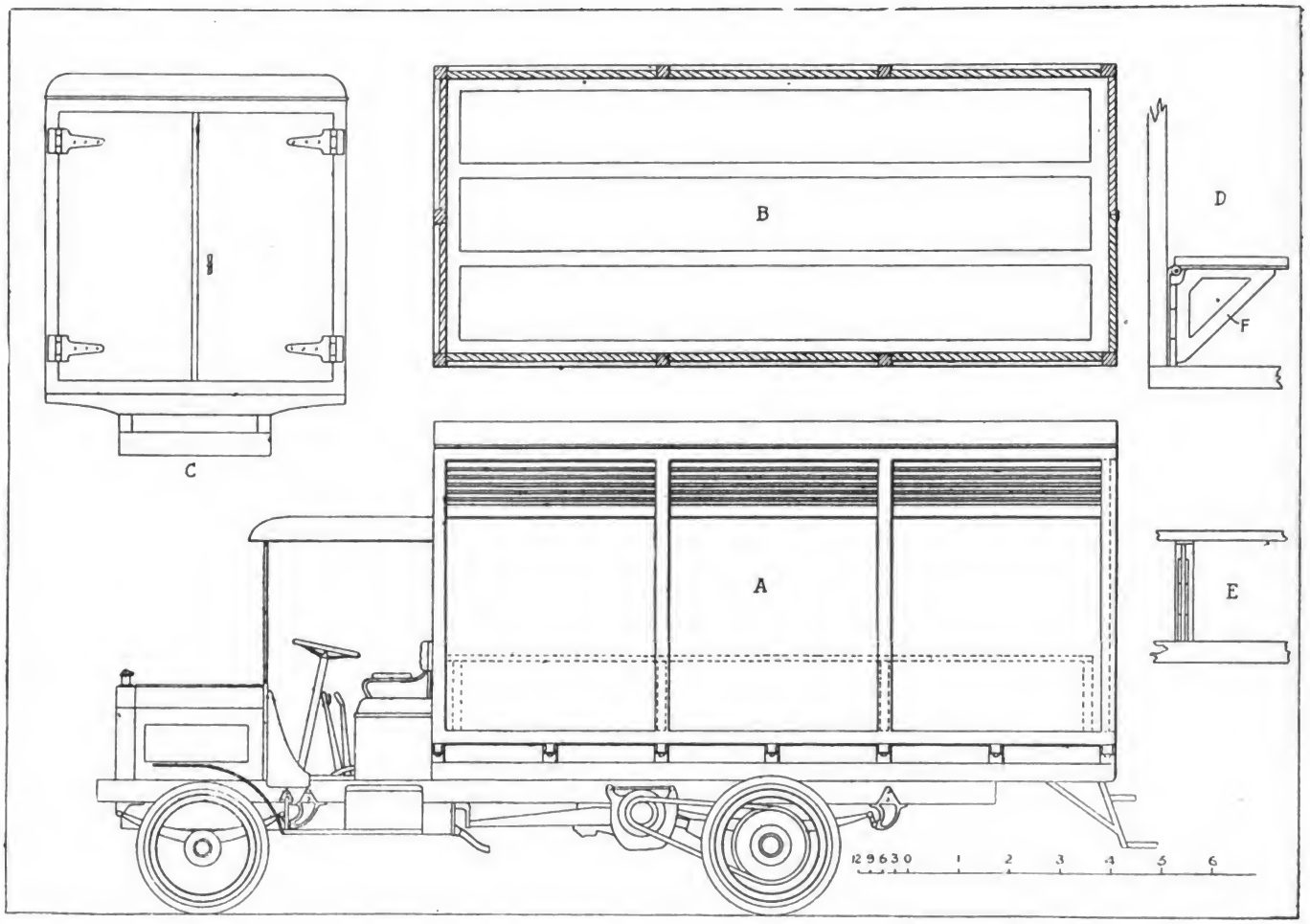
There has been a class of automobile drivers which has taken advantage of the conditions outlined and has operated what have been termed "jitney" lines. In the majority of cases in order to make these lines pay, the touring cars have been crowded to capacity on their runs and not all of the people have been served by such lines.

There is a general demand for a large capacity automobile truck, capable of carrying a large number of people during the rush hours, yet a machine which could be used for other purposes besides. In the country towns such a bus could not be operated at a profit during the day, though it pays large dividends during the rush hours in the morning and in the late afternoon.

Doubtless within the near future many enterprising business men will take advantage of these conditions and establish regular bus lines in the various parts of the country. The blacksmith, if he is inclined to do so, may construct a body for a large chassis as the Packard truck, which may be used for bus service and for general moving or hauling purposes during the rest of the day.

Such a body is illustrated in our drawing this month and shown mounted upon a Packard truck chassis. The body is designed primarily for hauling work, for carrying furniture, or in fact any commodity which may be bulky. The body proper measures 13 ft. 6 in. in length, 6 ft. in width and 6 ft. 4 in. in height. It is mounted upon seven cross bars which in turn are supported by two bar rails. The bar rails rest upon the frame of the truck.

The bottom of the body itself is a frame, all corners of which are mortised together and strengthened by means of angle irons. To add strength to the floor, two lengthwise sills are mortised into the frame at each end, across the center. A plan view of the frame and body members is shown at B.



There are nine upright posts, measuring 3 x 3 in. which support the roof of the car and upon these posts rests the frame constructed of four top rails. These top rails carry the top or roof bows. The top is constructed from thin wood, canvas covered or heavy wood tongued and grooved and made water-tight.

In order to provide ventilation for the body, the sides are fitted with slat openings. The panels (eight in number), are cut at a distance 4 ft. from the floor and are arranged so that the upper parts may be removed within a few minutes so as to leave the sides open.

At D, E and F are shown the details of the seat construction. F is a swing bracket, one of which is hinged to each of the nine uprights. When not in use it folds against the side of the body and permits the seat board

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which is also hinged, to drop down against the side or be raised, as is most convenient.

With this seat construction all of the seats can be raised or dropped out of the way and the van used for carrying large boxes or merchandise of any kind. With the seats in place and the panels removed the machine may be used for carrying passengers The rear doors are mounted upon large double hinges and the hinges are so arranged that the doors may be swung open and forward so as to fold lengthwise along the body and leave the rear of the body entirely open.

The steps (two in number) are also hung on hinges and can be folded up beneath the car when the machine is used for carrying merchandise. The body, being very simple in construction, can be made by practically any smith within a very short time and should find a ready sale in practically any town in the country.—Blacksmith and Wheelwright.

John Kearney Rodgers

The July issue of The Hub contained a brief announcement of the death of John Kearney Rodgers, assistant treasurer of the E. I. du Pont de Nemours & Co. The September issue of the Du Pont Magazine contained the following, which will be read with interest by his many friends in the carriage trade where he was very well known and extremely popular.

"'We sail, through friendly, charted seas,
A prosperous voyage; speeded here
By all the early, hard won victories,
When you were pioneer.'

"On Friday, July 4, 1919, J. Kearney Rodgers, one of the most widely known and esteemed men in the Du Pont organization, passed from this life, dying of a heart affection after a short illness.

"Although Mr. Rodgers was assistant treasurer for E. I. du Pont de Nemours & Co. since April, 1918, it is as director of sales for the Du Pont Fabrikoid Co. that he will be remembered by most of his many thousands of friends throughout the United States.

"Mr. Rodgers was born in 1857. His association with the leather substitute industry dates back to 1897 when, after a long experience in the sale of upholstery materials of other types, he became sales manager for the American Pegamoid Co. He remained with that company and its successors, the New York Leather and Paint Co., The Fabrikoid Co. and the Du Pont Fabrikoid Co. until his death, at which time he was still a vice-president of the latter company.

"Mr. Rodgers was without doubt the best known man in the leather substitute industry, as well as the man longest and most prominently identified with the sales end of that industry. It was largely due to his personal acquaintanceship with the many users of upholstery materials that his company was able to tide over many hard periods in the early days of its existence as manufacturers.

"During the 20 years of his sales management Mr. Rodgers saw his company grow from a struggling infant industry, with annual sales of a few hundred thousand yards, into the world's largest manufacturer of leather substitutes, with a production approximating ten million yards in recent years. This business was built up in defiance of obstacles that would have daunted and discouraged any man less capable or less determined. It was at first a

J. K. Rodgers

victory of personality over prejudice—a victory gained by convincing, consummate salesmanship over the universal prejudice then existing against 'artificial' leather. It was thereafter a long, hard-fought battle with strong competitors, a battle of the best business brains in America in which the Fabrikoid Co. has always kept its place in the sun."

(Continued from page 17)

empty 14,000 lbs., loaded 32,000 lbs. It is standard bombing type, powered with four Rolls-Royce Eagle 8 engines, giving 1,400 h.p., arranged in tandem, each front unit driving two-bladed propeller, and each rear motor four-bladed pusher of slightly greater pitch. The fuel capacity 2,000 gals. equivalent to 21 hours flying. Its average speed is 100 m.p.h. Wireless set has a range of 250 miles. Crew three pilots and wireless operator.

The R-34 is 650 ft. long by 79 ft. beam, and of the rigid girder type, girders being normally covered and concealed by outer shell. The lifting power is derived from 19 gas-filled inner balloonets, gas capacity approximately 2,000,000 cu. ft. From bottom of lowest gondola to top of gas bag is 92 ft. There are five gondolas, suspended from framework, and each powered with a Sunbeam Maori motor. Engines have 12 cylinders, of 3.95 in. bore and 5.31 in. stroke, arranged at angle of 60 deg. Engine develops 280 h.p. at 2,200 r.p.m., and normal output is 265 at 2,100, giving the big airship 1,325 horsepower. Full capacity of hydrogen would lift 60 tons, of which dirigible weighs 30. Other supplies carried on the westward trip were: Fuel, 4,900 gals., 15.8 tons; oil, 0.9 tons; water, 3 tons; crew and baggage, 4 tons; spares, 0.2 tons, and drinking water 0.42 tons, total 24.32 tons. Thirty officers and men were carried, 29 designedly and one stowaway

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Men of the Automotive Industry

Who They Are What They Are What They Are Doing

J. V. Weeks, superintendent of the chassis department of the Republic Motor Truck Co., Inc., has resigned.

Otto Bruenauer, formerly director of sales and engineering of the U. S. Ball Bearing Mfg. Co., Chicago, has resigned.

Edwin A. Godley has resigned as general office manager of the Republic Motor Truck Co., Inc., and has been succeeded by Glenn S. Crisp, chief accountant.

George W. Parks has been elected president and general manager of both the Maxwell Motor Co. of Canada, Ltd., and the Chalmers Motor Co., of Canada, Ltd.

George H. Daubner has resigned as chief engineer for the Barley Motor Car Co., Kalamazoo, Mich. His future plans have not been announced. L. F. Goodspeed is acting as chief engineer.

C. J. Brethaur has been made production manager of the Olympian Motor Car Co. He was formerly with the Commerce Motor Car Co., Buffalo, N. Y., and later with the Walden-Shaw Taxi Co., Chicago.

J. G. Vincent, vice-president of the Packard Motor Car Co., has been commissioned a colonel in the Officers' Reserve Corps. The appointment is to the aviation section of the signal corps and specifies a flying status.

Christian Girl, president Standard Parts Co., Cleveland, has been awarded the Distinguished Service Cross by the War Department in appreciation of the aid he rendered in developing the standard government motor truck.

Ralph S Allen has taken up his new duties as general manager of the Duratex Co., Newark, N. J. He was, prior to this move, associated with the Wagner Electric Co., Detroit, and formerly with the Gou'd Storage Battery Co.

S. A. Schaeffer, foundry superintendent of the Fairbanks-Morse Co., Three Rivers, Mich., has resigned to become assistant superintendent of the Clarage Fan Co., Kalamazoo, Mich. He is succeeded by B. C. Page, of Spokane, Wash.

R. S. McLaughlin, president of the McLaughlin Motor Car Co. and a vice-president and director of the General Motors Corp., has been elected president of the newly organized General Motors of Canada, Ltd., which has a capital of $10,000,000.

Arthur J. Slade, back from the war as a lieutenant-colonel of the Motor Transport Corps, with the British D. S. O. and the French Legion of Honor, has resumed his practice as a consulting engineer, with offices at 1790 Broadway, New York.

John S. Burdick has resigned as chief body engineer of the Locomobile Co., Bridegport, Conn., to become associated with K. B. McDonald and R. J. MacKenzie, owners of the Buffalo (N. Y.) Pressed Steel Co., as head of the engineering department.

C. L. Halladay, who has been connected with the industry since 1902 and who acted in the capacity of assistant chief of the Automotive Products Section of the War Industries Board, has been appointed assistant to C. C. Hanch, general manager of the Maxwell Motor Co.

Glenn D. Mitchell has resigned as chief engineer of the L. W. F. Engineering Co., College Point, L. I., to take up work with the Sinclair Refining Co., Chicago. In 1915 he went with the Curtiss Aeroplane & Motor Corp., Buffalo, and has been in the airplane industry ever since.

C. O. Corey, Rochester, N. Y., formerly with the Westinghouse-Church-Kerr Co., New York, as erecting engineer, will have direct charge of all engineering operations at the Stamwood Rubber Co.'s plant at Newark, N. J., under the supervision of Edward Hutchens, vice-president and engineer.

Harry M. Giles has been appointed general superintendent of the South Philadelphia works of the Westinghouse Electric & Mfg. Co., succeeding Oscar Otto, who was recently killed in an automobile accident. Giles has been superintendent of marine erection for the company for a number of years.

Victor Grieff, after two years service in the Navy, where he served as lieutenant, has become research engineer for the American Bosch Magneto Corp., Springfield, Mass. Grieff was formerly connected with the Covic Electrical Co., and previous to that was with the New York Edison Co. and the General Electric Co.

A. A. Schneider has been appointed manager of the newly created raw materials division of the American Steel Export Co. He was formerly with the raw materials department of the Midvale Steel & Ordnance Co. and the Cambria Steel Co., and was recently released from service as lieutenant of field artillery.

H. F. Harris, who has had engineering experience with the Everett, Studebaker, Maxwell, and Overland organizations, and for the past two years has been with the Republic Motor Truck Co. as industrial engineer and later as general sales manager, has been appointed general manager of the Bethlehem Motors Corp., Allentown, Pa.

Henry Beneke, formerly vice-president of Hibbard, Spencer, Bartlett & Co., has purchased the entire interests of Frederick Findeisen and becomes vice-president and treasurer of the Findeisen & Kropf Mfg. Co., now the Beneke & Kropf Mfg. Co. O. F. Kropf remains with the company as active president, and A. E. Bates continues as director of sales and advertising.

Charles P. Grimes has been appointed development engineer of the Root & Van Dervoort Engineering Co. He will have charge of the dynamometer testing laboratory to be installed. He was formerly with the Wheeler-Schebler Carbureter Co., Indianapolis, and with the National Motor Car Co. & Vehicle Corp., Indianapolis. During the war he worked at McCook Field, Dayton, O., supervising the installation of electrical dynamometer and other testing equipment for the Liberty engine.

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Activities of Automotive Manufacturers

Where They Are Located What They Are Doing How They Are Prospering

Haynes Automobile Co., Kokomo, Ind., has let the contract for an addition to its plant to cost $600,000.

Autocar Co., Ardmore, Pa., manufacturer of motor trucks, has increased its capital stock from $2,000,000 to $10,000,000.

Paige-Detroit Motor Car Co., Detroit, is reported to have arranged for the issuance of $3,000,000 of additional preferred stock.

Tulsa (Okla.) Auto Mfg. Co., Oklahoma and Wheeling streets, R. O. Holleron, manager, will install equipment for a $500,000 plant to manufacture automobiles.

Stutz Motor Car Co. of America, Indianapolis, Ind., will soon commence the construction of additional buildings which, with equipment, will cost approximately $800,000.

Clark-Robertson Vehicle Corp., Buffalo, has been incorporated with a capital of $50,000, by Howard J. Clark. A. A. and N. E. Robertson, to manufacture wagons, parts, etc.

Fremont (O.) Motor Corp. has been organized with a capital stock of $2,000,000 to operate the Burford plant. It is stated that passenger cars and motor trucks will be made.

Hudson Motor Car Co., Jefferson street, Detroit, is having plans drawn for a one-story addition, reinforced concrete, 300 x 300 ft., to cost, with machinery, about $325,000.

Keystone Wagon Works, 1949 North Second street, Philadelphia, is having plans prepared for a three-story brick addition at Second and Morris streets, 45 x 109 ft., and 60 x 74 ft.

Inland Motor Truck Co., Evansville, Ind., has been incorporated with $250,000 capital stock to manufacture motor vehicles. The promoters are Elmer Q. Lockyer and Henry J. Graf.

Equitable Motor Truck Co. has been incorporated with a capital of $50,000 by E. M. Bernstein, M. Monfried and J. C. Barron, 105 Henry street, New York, to manufacture truck parts, equipment, etc.

Pacific States Motor Truck Co., Seattle, recently incorporated with $300,000 capital stock, will erect a factory at a cost of $45,000 for the manufacture of 3 and 4-ton motor trucks. The building will be two stories, 180 x 60 ft.

Kissel Motor Car Co., Harry P. Branstetter, agent, 50 East 26th street, Chicago, is having plans drawn for a three-story service station, 100 x 103 ft., to be constructed on Michigan avenue near 26th street, at a cost of $70,000.

General Motors Corp. has let contract for the erection of a plant at Natural Bridge and Union street, St. Louis, and work will commence at once on three buildings to cost $2,000,000 including equipment. The plant will employ 8,000 men eventually.

Monitor Motor Car Co., Columbus, O., has purchased the plant formerly occupied by the Scioto Rubber Co., and will equip it for the manufacture of motor cars. The works on Cleveland avenue will be kept in operation until the new building is ready for occupancy.

Hoffman Bros. Motor Co., Elkhart, Ind., will put a new six-cylinder passenger car on the market after December 1, and is erecting a $200,000 addition to the present motor truck plant, which will be completed before winter and will be used for the increased production.

American Truck Co., 19 West 44th street, New York, Darwin R. James, president, has broken ground for the erection of its proposed new plant at Thompson street and Nott avenue, Long Island City. The structure, with equipment, is estimated to cost about $1,000,000.

Stoughton (Wis.) Wagon Co., which is erecting an addition, will engage in the manufacture of motor trucks, largely as an assembling concern. Some new tool equipment is being purchased. The trucks will be made in 1½, 2 and 2½ ton capacities. F. J. Vea is president.

Cleveland (O.) Automobile Co., although but a few months old and with its factory recently compelted, has orders for more than 30,000 cars for the present automobile year, and has issued orders for increasing the capacity of its plant. The factory has been in production since July 31.

O. Armleder Co., Cincinnati, which has been building delivery wagons for the last 38 years and truck for the past ten, has discontinued the horse-drawn vehicle business. It is remodeling its plant to devote it exclusively to motor truck manufacture with facilities for 20 trucks per day.

Packard Motor Car Co., Detroit, has under construction a three-story extension to its plant which will add about 250,000 sq. ft. of floor space to the present total of 60 acres. More than $1,750,000 will be invested in the building and equipment. It is expected that the new unit will be in operation in about six months.

Ogren Motor Car Co., Milwaukee, has started work on remodeling a building at 692-698 National avenue, into a machine shop and assembling room for the production of passenger automobiles. Most of the equipment has been ordered but several items remain to be purchased. Hugh W. Ogren is president and general manager.

Parts Makers

Harrison Radiator Corp., Lockport, N. Y., has let contract for a reinforced concrete addition, 38 x 160 ft.

Standard Parts Co., Cleveland, O., will build a one-story addition to its plant at Pontiac, Mich., 100 x150 ft.

American Auto Trimming Co., Walkerville, Ont., will erect a five-story addition to its plant at a cost of $160,000.

Sandusky (O.) Mfg. Co. has purchased the Vim Motor

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plant in that city and will install equipment for the manufacture of automobile rims.

Timken Roller Bearing Co., whose new plant at Columbus, O., is under construction, has taken over the plant of the Superior Tool & Die Co., Columbus.

United Auto Products Co., Wilkes-Barre, Pa., has been incorporated with a capital of $10,000 to manufacture automobile parts, equipment, etc. Edgar A. Conroy heads the company.

Electric Storage Battery Co., 19th and Allegheny streets, Philadelphia, has filed plans for the erection of a one-story addition to its plant, 32 x 97 ft., at 19th and Willard streets, to cost about $14,000.

Northern Wheel Co., Alma, Mich., a recently organized corporation, will soon break ground for the first unit of its plant to be used for the manufacture of wheels for automotive vehicles. The building will be 60 x 300 ft.

McCord Mfg. Co., manufacturer of radiators ,and the Russell Motor Axle Co., both of Detroit, Mich., have been consolidated under an arrangement which gives the first named company control. The combined assets are $4,000,000.

Brown, Lipe, Chapin Co., 110 Seneca street, Syracuse, N. Y., manufacturer of gears, automobile transmission, etc., is having plans prepared for a new five-story plant, 70 x 78 ft., at West Fayette and Ontario streets, to cost $100,000.

Body Builders

Lang Body Co., Cleveland, has placed a contract for a four-story factory, 160 x 260 ft.

Anchor Top & Body Co., Cincinnati, is increasing its facilities to take care of growing trade.

Highland Body Mfg. Co., Cincinnati, has opened a branch in Detroit, in charge of P. H. Willis.

Waterloo (N. Y.) Wagon Co. will erect a plant for the manufacture of automobile and truck bodies.

Murray Auto & Parts Co., Atlanta, Ga., is planning to establish a plant for the manufacture of automobile bodies and sheet metal parts.

Columbus (O.) Commercial Body Co. is adding equipment that includes metal working machinery for the manufacture of automobile bodies.

Martin-Parry Corp.'s plant at Indianapolis is to be enlarged to have double the present capacity. The plant will be rearranged and additions built.

Smith Bros. & Sklar, Inc., Brooklyn, N. Y., has been incorporated with a capital of $20,000 by J. Sklar, M. and H. Smith, 136 Hall street, to manufacture automobile bodies.

Leroy M. Cline and Peter F. Emmert, machinists, Lebanon, Ind., have organized a company to manufacture automobile truck cabs and tops, and do a general machine repair work.

Fields Mfg. Co., manufacturers of motor truck bodies, Owosso, Mich., has begun work on an addition that will double its capacity, adding 600,000 sq. ft. of floor space to its present plant.

Wilson Body Co., 26th and Farragut streets, Bay City, Mich., has completed plans for the erection of a one-story brick addition to cost about $200,000, including equipment. C. R. Wilson is president.

Newark (N. J.) Auto & Body Repair Co., 131 Newark street, has filed notice of organization to manufacture automobile parts, etc. Thomas J. Gorman, 249 Hight street, heads the company.

Universal Body Corp., New York, has been incorporated with a capital of $200,000 by J. N. Scelba, W. M. Hall and K. Lorenz, 35 Wall street, to manufacture automobile bodies and motor mechanical appliances.

York (Pa.) Body Corp., Belvidere and Linden streets, manufacturer of automobile bodies, has awarded a contract for the erection of a new four-story and basement works, 72 x 106 ft., to cost about $35,000.

A. J. Miller & Co., Bellefontaine, O., manufacturer of automobile bodies, announces that the business of the concern will be continued and enlarged by Lee M. Lentz and John W. Grabiel, executors of the estate.

Indianapolis (Ind.) Body Corp. has been incorporated with $25,000 capital stock to manufacture automobile bodies and accessories. The directors are Harry P. Millspaugh, Clarence R. Irish and Peter M. King.

Transport Body Co., 641 Santa Fe avenue, Los Angeles, Cal., manufacturer of automobile bodies, has had plans prepared for the erection of a new one-story plant, 140 x 220 ft., at Santa Fe avenue and Porter streets.

Irvin Robbins & Co., Indianapolis, body building concern, will begin immediately the erection of an addition to its plant. The building will be two stories high, of brick veneer, 60 ft. wide and 400 ft. long, costing approximately $80,000.

T. J. Barnes, Pittsburg, Kas., has broken ground for a new plant, 50x 80 ft., at 104 Locust street, to be equipped for the manufacture of automobile bodies, with machine shop for repair work. The works will cost about $70,000, including machinery.

Brown Auto Carriage Co., Cleveland, has been reorganized as the Brown Body Corp., with a capital stock of $1,000,000 and will engage exclusively in the manufacture of automobile bodies. It has acquired 3½ acres on Maywood avenue between West 90th and West 92d streets, and will shortly begin the construction of the first unit of its plant, which, it is stated, will eventually contain 200,000 sq. ft. of floor space.

Fisher Body Corp., Detroit, stock recently climbed over 40 points in less than a week. This unusual jump is said to be due to a semiauthentic report that a reorganization of that company is contemplated, calling for a new stock issue in which present stockholders will be allowed to participate. It is also reported that the Fisher Body Corp. has made all arrangements for the immediate construction of a large plant in Cleveland to handle the increasing business of that territory.

Buffalo (N. Y.) Body Corp. has been incorporated by R. J. MacKenzie and K. B. MacDonald, owners of the Buffalo Pressed Steel Co. It will manufacture high grade closed automobile bodies. J. S. Burdick, formerly with the Locomobile Co., Bridgeport, Conn., has been made vice-president and will have active charge of engineering. The new company will occupy the buildings on the 5½-acre site recently purchased, formerly occupied by the Buffalo School Furniture Co., containing about 150,000 sq. ft. of floor space.

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The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

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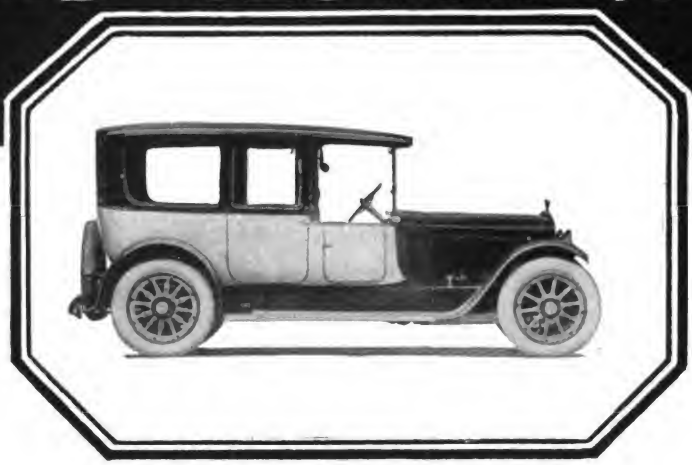

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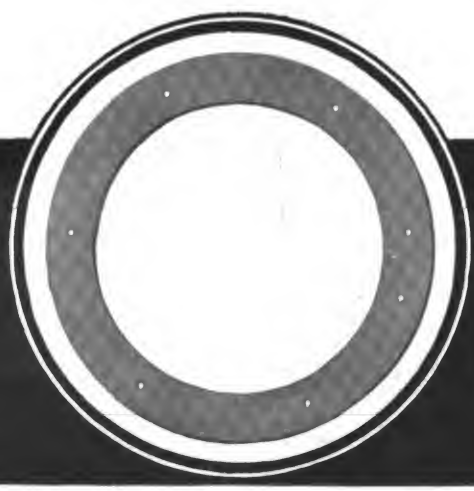

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The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXI NEW YORK, OCTOBER, 1919 No. 7

Export Opportunities for Automotive Products--V

Countries Where American Output Can Be Sold, Reasons Why They Are Needed and Precautionary Methods Necessary in Selling and Delivery

(Continued from page 193 Automotive Engineering, April issue. Interested subscribers can obtain the previous issues for 1919, April and January, upon application, as long as the supply lasts)

WHILE the present situation among American automotive manufacturers is such that more vehicles can be sold in this country than the factories can produce, in fact right now the shortage which has existed all spring and summer is still evident, it is only the part of good sense and business wisdom to prepare for the future. This preparation should include, of course, some provision for the sale of the output other than the domestic needs, that is, provision should be made for exporting. While the manufacturer may be both busy and prosperous today, it may be considered as simply insurance against a total failure to build up a strong foreign clientele against the day when the home demand may not be so good.

Moreover it should be pointed out that the time to do this most easily and at the least expense is a time like the present when the world is fairly crying for our automotive products. One of the biggest needs of today all over the world is food, or rather crops, and these can be increased without more labor (which is not available) by using modern American methods of tilling the ground. These methods include the use of tractors in place of horses for pulling the various farming implements such as plows, harrows, cultivators, manure spreaders, etc., and in all the other preparations of the farm, such as shelling corn, pumping water, sawing wood, filling silos, etc. As has been pointed out in the last installment of this series, the tractor is used slightly more than half of its working time as a power plant.

Opportunities in Latin-America

The countries near at hand, such as Canada, South America and Latin-America offer good fields, but fields which must be handled with care, for the people are different in their habits, methods of thought and of work, and in other ways. Thus, in Latin-America, as in many other places, one of the chief obstacles to the introduction of tractors is the natural aversion of a conservative people to new and complicated mechanisms. When inexperienced operators fail in their use of a new machine they invariably condemn it. The manufacturer must overcome this in advance through adequate instructions and demonstrations, as well as through the selection of the tractor to fit the particular kind of work.

Another obstacle in selling tractors in Latin-America is the high cost of gasoline, but it is probable that after normal commerce is resumed there will be a reduction in the price of this fuel. In contrast with the scarcity of fuel for tractors, the ranch owner has available a large supply of horses and practically unlimited natural pasture, making his outlay for animal power comparatively small. To meet this condition the manufacturer must demonstrate that the land can be much more quickly and evenly worked, and to a much greater depth with the use of the tractor than is possible with animal power; he must show that in the planting season not an hour need be lost because of a scarcity of laborers or horses; every moment can be utilized by the tractor, and the fields can be plowed, harrowed and planted at the most favorable period.

Exports of Tractors to Latin-America

The Latin-American countries that are foremost in experimenting with tractors are shown in the following table of exports of these machines from the United States in the last fiscal year and the first quarter of the fiscal year. These figures include only internal combustion engines:

Country	Number		Value	
	1917-18	1918-19*	1917-18	1918-19*
Mexico	285	36	$430,472	$77,701
West Indies:				
Cuba	165	82	247,662	103,974
French West Indies	2	...	2,095	.....
Haiti	1	...	1,150	.....
Dominican Republic	4	...	3,590	.....
Central America:				
Guatemala	1	...	802	.....
Nicaragua	2	2	2,800	3,781
Panama	16	...	12,412	.....
Salvador	..	1	.....	1,400
South America:				
Argentina	7	33	4,050	57,274
Brazil	4	11	11,600	12,600
Chile	16	...	18,296	.....
Columbia	12	...	10,728	.....
Paraguay	6	...	7,111	.....
Peru	83	63	101,594	59,995
Uruguay	..	7	.....	5,495
Total	604	235	$854,362	$322,220

* First three months of the fiscal year ending June 30, 1919, covering July, August, September, 1918.

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Mexico Leads in the Importation of Tractors

In the fiscal year 1918 the United States shipped almost as many tractors to Mexico as to all other Latin-American countries, Mexico's share lacking only 34 of the combined total of the others. The leading position of this neighboring country in our export trade in tractors is due to the action of the Mexican government in stimulating agriculture by exempting farming implements from import duty, and even by importing such machinery for sale at cost to Mexican farmers. The secretary of the Mexican Department of Agriculture recently visited the United States where he purchased a supply of tractors and other implements which are to be demonstrated at the agricultural station at Oaxaca and in other farming sections. American counsels in Mexico report great opportunities for the tractor to prove the agricultural possibilities of the land that has heretofore been worked by peon laborers and slow-moving oxen. The caterpillar type of tractor appears to be most popular and best adapted to the needs of the country, though other types are being demonstrated with satisfaction in some localities.

Cuba Second in Tractor Imports

Next to Mexico in the purchase of tractors from the United States comes Cuba, where they are widely used, in fact, almost wholly used, on the sugar estates. The tractors used on the sugar estates of Cuba are of two kinds—the round wheel and the track-layer or caterpillar style, and are used almost exclusively for plowing. In the northern section of the Cienfuegos province, owing to the hard, sticky, clayish soils, the caterpillar type seems to be the most successful, as it is claimed that in the use of round-wheel tractors there is a constant slipping of the wheels with the consequent loss of power and breakdowns. In the central and southern part of this district the round-wheel tractors seem the most successful, and they have been found to be very satisfactory and economical—more economical when alcohol is used instead of gasoline.

In the southern section tractors of 8 to 16 and 12 to 25 horsepower have been used to some extent for hauling purposes as well as in connection with the use of cane-planting machines. Experiments have also been made here with the track-layer type in connection with cultivating between the rows of cane. The chief objections to this type seem to be that its first cost is very much higher than the round wheel; that it is complicated and therefore more liable to breakage, and more difficult for inexperienced operators to handle. Several plantations are to experiment in the use of different kinds of tractors, and especially with the caterpillar type, for the purpose of hauling cane.

In one instance at Cienfuegos two tractors were used last year but six are now in operation, as the owners have realized the advantages of these machines in the present scarcity of labor. The work of the plow drawn by tractors is found to be more uniform and much deeper than that of the oxen-drawn plow, and this better preparation of the soil more than compensates for the expense of the machine. Alcohol is often used as fuel in this section, though in other localities gasoline is available for the motors. The use of tractors is confined chiefly to the older cultivated lands in the provinces of Habana, Matanzas and Santa Clara. In the Camaguey and Oriente provinces the sugar plantations were converted from timber lands, and the logs and stumps still in the fields prevent the satisfactory use of tractors. However, the sugar companies are looking for results and they do not hesitate to introduce the best modern machinery that proves profitable. Where railroad facilities are not available tractors are used for hauling the cane to the mill and also for hauling ore from the mines to the railway stations. They could be used to great advantage in road construction in many districts where poor roads retard the development of agriculture.

Peruvian Agriculture to be Revolutionized by Tractors

Peru is another sugar producing country which is beginning to appreciate the value of tractors, having imported at the rate of 21 per month during the first quarter of the 1919 fiscal year. This rate would treble the imports of the last fiscal year, and it indicates that the large sugar plantations in the valley lands of Peru are rapidly replacing by tractors the oxen power which has been used in that country since the earliest days of Indian farming. One estate has shown that a tractor can do in one day what it takes 15 men with 15 yoke of oxen to accomplish in the same time. Both the sugar and cotton plantations are using the tractors, and special machines for the rice fields are giving remarkable satisfaction.

Argentine Experiments With Tractors

Argentine was among the first of the Latin-American countries to introduce power plows, having imported a considerable number in 1913. In some parts of the country the rough character of the land prevented complete success, and in many cases the first operators, being wholly inexperienced, were unable to obtain good results. These difficulties led to a decline in the popularity of tractors and only in recent months has there been a recovery from this disfavor. From July 1 to October 1, 1918, more tractors were shipped from the United States to Argentina than in the four previous years. Late in 1917 the secretary of the Argentine Agrarian League prepared a report on the use of farm tractors in Argentina, setting forth the relative advantages of power and animal plowing. The high cost of gasoline and the cheapness of pasture have always been cited by Argentine objectors to the introduction of tractors, but the investigation of the Agrarian League showed that the greater speed of the tractors and their deeper working of the soil more than compensated for the cost of the fuel in addition to the initial cost of the machines. The saving in time during the planting season was forcibly shown, as was also the saving in labor and in feed for draft animals.

With the large recent increases in the imports of automobiles into Argentina the operation of motors is becoming more familiar, and the difficulties experienced at first will soon be forgotten. The enormous stretches of level wheat growing land in Argentina offer unsurpassed opportunities to the manufacturer of tractors, while the interest in road making in that country presents an almost untouched field for the same product.

Tractors in Chile and Brazil

In the grain raising valleys of Chile there are also large areas of level land, well suited to cultivation by tractors. Many steam engines are used on the great Chilean estates, but they have not proved entirely satisfactory because of the difficulty of keeping up sufficient pressure with wood fuel. The lack of success with these engines has doubtless prevented a more cordial reception to gasoline tractors, but the small though record number of tractors imported by Chile in 1918 should lead to increased demands

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for this class of power. While agriculture is chiefly developed in the interior of Chile, the American consul at Punta Arenas reports power farming implements are well suited to that country, as it is gently rolling, and recent developments show that crops can be grown there to advantage. Moreover, laborers are scarce and wages are high at the present time. Heretofore the attention of the ranch owners in that region has been devoted chiefly to stock raising, but they are ready to spare no expense for improved farming machinery. As an indication of the buying power of the community the consul estimates that there are about 1,400 automobiles in the rather sparsely populated territory served through the port of Punta Arenas.

In Brazil, as in Cuba, the problem of stumps of trees in cleared fields meets the manufacturer of tractors. Most of the cultivated land was originally a forest or jungle, and the crops are planted among the stumps. By the time the stumps have rotted out the land has deteriorated and the owners clear new fields instead of fertilizing the old. In time, of course, these fields will continue in use, and there are, moreover, in the southwestern section of Brazil large tracts of prairie land which when cultivated will create a demand for tractors. In the great coffee districts of Sao Paulo, for which the port of Santos is the outlet, there is little use for tractors. In the state of Pernambuco the field is limited because of the mountainous character of the land, though some tractors are used in the sugar and cotton growing regions. In the sugar district of the state of Rio de Janeiro several tractors are in operation, the demand being for small, compact machines. In the rice fields of Sao Paulo tractors have been well received. An American government investigator reports that tractors for Brazil should be equipped to avoid deterioration by the prevailing dampness, and they should also be provided with canopies to afford protection from the sun.

Tractor Opportunities in Other Countries

In spite of the fact that practically all of the 75,000 acres which are planted to sugar cane in the colony of Gaudeloupe, French West Indies, could be plowed and cultivated by tractors, there are at present but seven of these machines in use. The islands of Grande Terre and Marie Galante, where most of the cane is grown, are almost level, and the portions now under cultivation are divided into about 1,100 estates which vary greatly in size. The soil is heavy and in many places marshy. All of the tractors in the island were brought from the United States. Both light and heavy tractors are in use, both classes apparently giving satisfactory results.

The planters depend on oxen and mules for means of cultivation and transportation of the cane to the receiving stations of the centrals. It is estimated that approximately 12,000 oxen and 3,000 mules are now being used in the sugar industry. Sufficient cattle are raised in the colony to supply the demand for oxen, but almost all of the mules have to be imported from other islands or from the United States. Pasture for work animals is always plentiful, as a great deal of land is not under cultivation.

The greatest drawback to the use of tractors in Guadeloupe is the lack of experienced operators. The ordinary laborers cannot drive such machines. Other obstacles are the numerous ditches which are found in the fields, the high cost of fuel, and the lack of initiative on the part of the planters.

The duties charged on tractors when imported from countries other than France are $1.31 per 100 pounds net, plus 3 per cent ad valorem. Such machines of French manufacture pay only the local duty of 3 per cent.

Uruguay is a small but rich agricultural country which has just begun to appreciate the possibilities and advantages of tractors. Bolivia has a large farming section under development at Cochahamba, where small tractors adapted for operation in high altitudes would fit in well; Colombia, Panama, Venezuela and even the smaller Latin-American countries offer promising fields for tractors and could be counted upon for occasional orders.

This installment has been devoted to tractors, because in the present world-wide demand for more and cheaper food, the agricultural tractor has assumed a position of tremendous importance. The next installment will take up motor cars and bodies.

Acetylene Motors

Even before the war various attempts were made to employ acetylene to run automobile motors. As long as gasoline was plentiful, however, the difficulties in the way of using acetylene seemed discouragingly formidable. During the war, however, more determined attempts were made to solve this problem. Le Journal de l'Acetylene has just published a report by an engineer named Keel, describing the results obtained by various Swiss experimenters; no less than eight important firms experimented with acetylene motors and the Swiss army likewise made a study of the question. The acetylene employed may be of two kinds: acetylene dissolved in acetone or the acetylene produced directly from calcium carbide. The dissolved acetylene has the advantage of being pure and of being kept at a suitable pressure; on the other hand it requires the use of containers of considerable weight—15 kilograms of dead weight per cubic meter of gas. The acetylene produced directly must always be carefully purified and filtered. Among the advantages exhibited by these motors are their silent functioning, the ease with which they are started, and the cleanliness of the service.

One 30 h.p. motor (four cylinders) making 100 revolutions, consumes 260 liters of acetylene per horsepower and per hour. The average requirement is 1 kg. of carbide per horsepower and per hour. A 700 kg. automobile traveled 35 km. with 7 kg. of carbide without the injection of water. In short, one kilogram of carbide is equal to 0.66 liters of gasoline (benzine).

Automobile Capital Over Billion and a Half

Recent estimates of the capital invested in automobile manufacturing show that this now totals slightly more than $1,500,000,000. This is half a billion more than the total capital of our national banks as of 1917 ($1,080,000,000). Incidentally it indicates that the whole automotive industry must have an invested capital in excess of three billions for the truck, tractor, airplane, motorcycle and other parts of the industry taken together are at least equal to that of the automobile.

Government May Buy Curtiss Buffalo Plant

Chairman Kahn, of the House Military Affairs Committee, has introduced a bill under the provisions of which the government, through Secretary Baker, would pay the Curtiss Aeroplane & Motor Corp. $6 114,126.03 to settle war contracts and buy the company's Buffalo plant.

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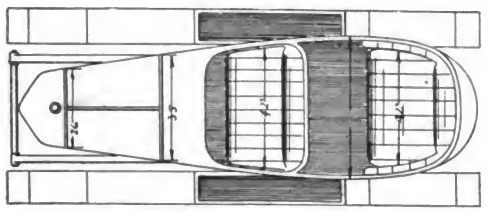
Ideal Car Serial—No. 9

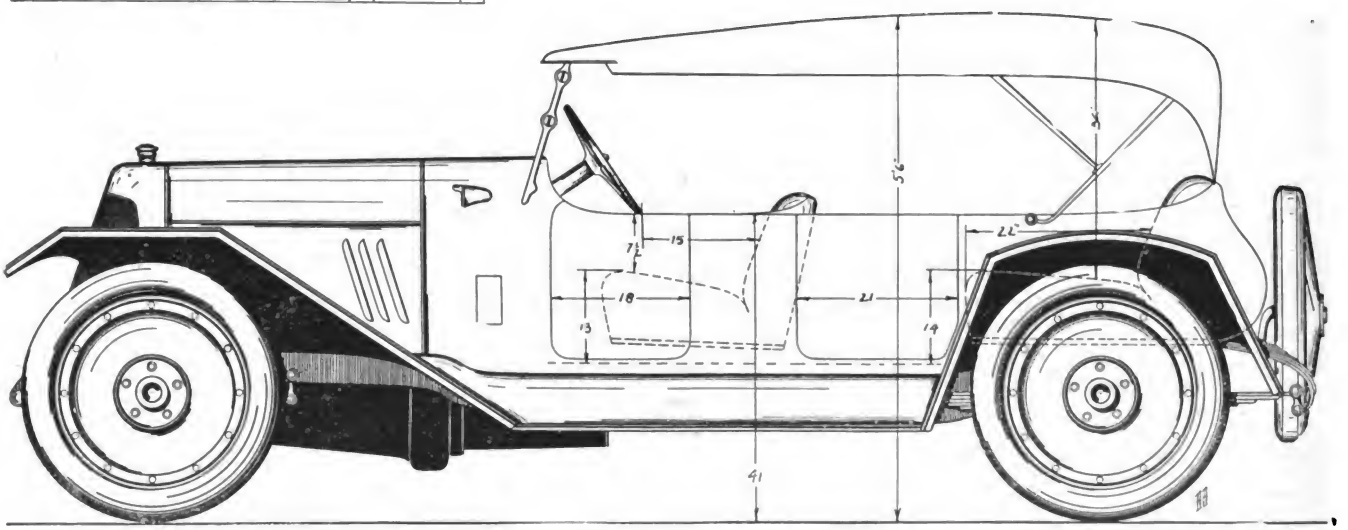
Sporting Four-Passenger Touring Car

Specially designed for The Automotive Manufacturer by
BEDA BROZIK

There is no doubt that the modern tendency in car construction is toward long and low bodies, especially low. Now that American roads have been so improved that one can tour almost anywhere without leaving a hard surfaced road, there is little question that American chassis designers will follow foreign leads and build into the new models some of that smart lowness which has always characterized the best foreign productions. The foreign machines have been used on hard roads exclusively so that they did not have to have excessive clearance, and the people who bought these cars in the past planned to use them only in and around the larger cities so that the usual American high clearance chassis was not necessary.

Now, however, with road conditions so radically changed there is no good reason why all American cars should not be much lower. The accompanying ideal body, the writer's idea of a would be popular touring car is not alone extremely low itself but is shown on an extremely low chassis. This will be noted in the first glance at the dimensions, the total height over the raised top being but 5 ft. 6 in. Considering this, people standing on the sidewalk, which is higher than the pavement, would easily look over the top of this little ideal car. The advantage of this particular design is that comfort of the passengers has not been sacrified, as witness the deep springs, wide seats, ample leg room.





Sporting Four-Passenger Touring Car

The distinctive features of this body are: A small and narrow four-passenger car, with very low seating, easy riding, with the passengers directly over the rear axle, flush sided construction with round cowl and fish-tail rear end. The latter improves the balance and provides a handy locker space as well. A one-man top of special construction is indicated, this laying flush with the body sides and almost on the top of the fenders. The angular shape of the fenders carries out the same long low appearance and give a distinctive note to the whole car.

Characteristics of the chassis: Wheelbase, 124 in.; body space, 102 in.; height of radiator, 24½ in.; steering post, 28½ x 21 in.; wheels, 34 x 4½ in.; tread, 56 in.

Examples of Fine Coach Work

On the facing page are presented two samples of the best American coachwork, a cabriolet and a sedan. The former has a completely enclosed passenger compartment, the enclosure being constructed along landaulet lines. The entire top folds back flat so that when the envelope is put on over it and the front pillars are dropped over the division back of the driver's seat, the car has the appearance of a touring car.

The car is painted a rich blue and is upholstered in khaki colored broadcloth. The driver is protected from the weather by a leather extension curtain which is detachable and is used only in inclement weather.

The chassis is a Cadillac, with Rolls-Royce radiator, and the body was especially designed and built by the Holbrook Co., New York, for E. T. Stotesbury, Philadelphia.

Henry Ford & Sons, Dearborn, Mich., plan an output of 150,000 Fordson tractors in the fiscal year 1919-20, that is beginning June 1, 1919. In the 14 months previous to this date 53,078 were produced.

Cheaper Method of Making Rustproof Steel

One of the drawbacks which has prevented the more universal use of stainless or rustless steel has been the supposed necessity for making this from an alloy containing chromium, which is very expensive to make and handle. Attention is now called to the fact that introducing a minute proportion of copper into the steel has the effect of greatly reducing the tendency to rust. Steel sheets made in this country from ingots containing .012 to .254 per cent of copper were exposed in a recent English test to a very corrosive atmosphere with others containing no copper. While the former did not resist corrosion entirely they were vastly superior to the non-copper sheets.

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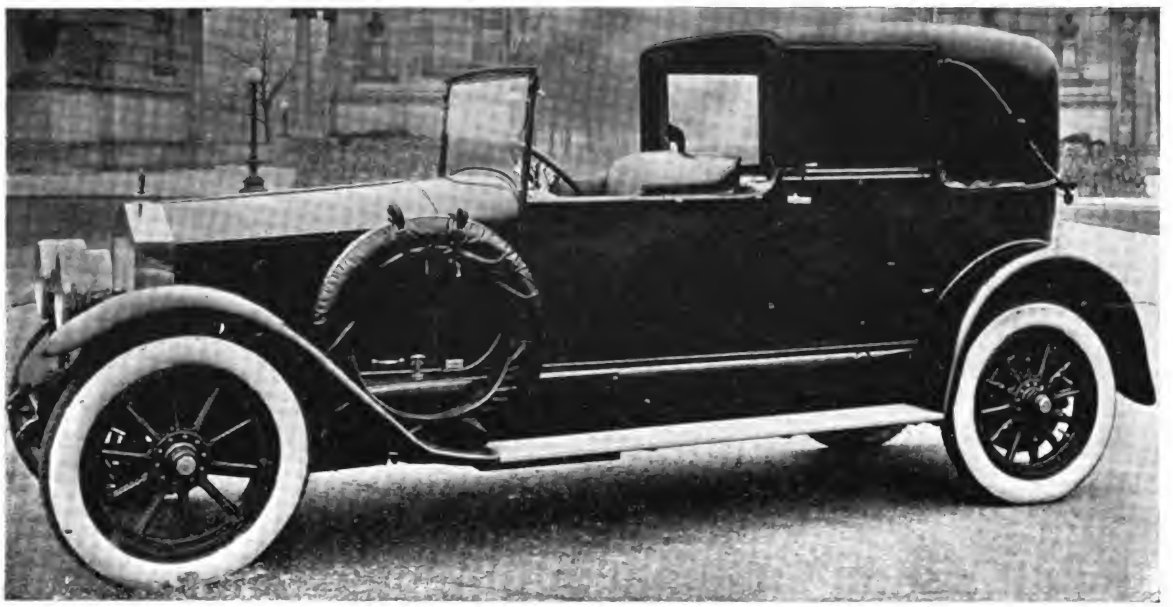
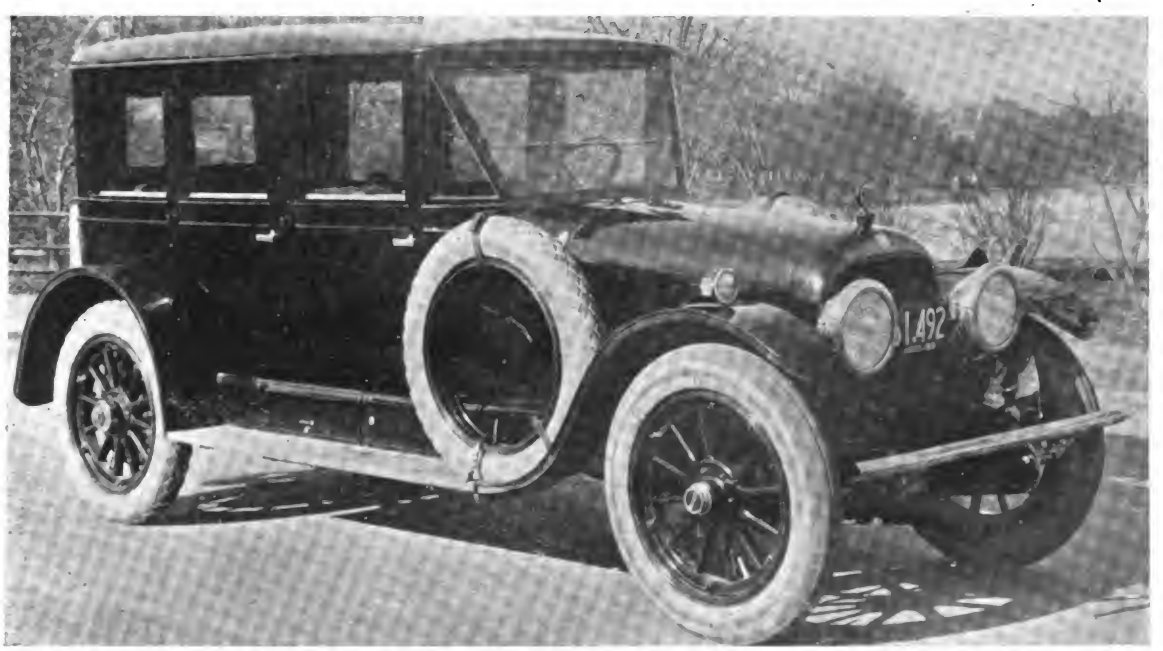
Examples of the Best American Coach Work



TOWN CAR CABRIOLET
Body built by The Holbrook Co., New York
Mounted on Cadillac chassis



SEDAN WITH INCLINED GLASS FRONT
Built by James Cunningham Son & Co., Rochester, N. Y.

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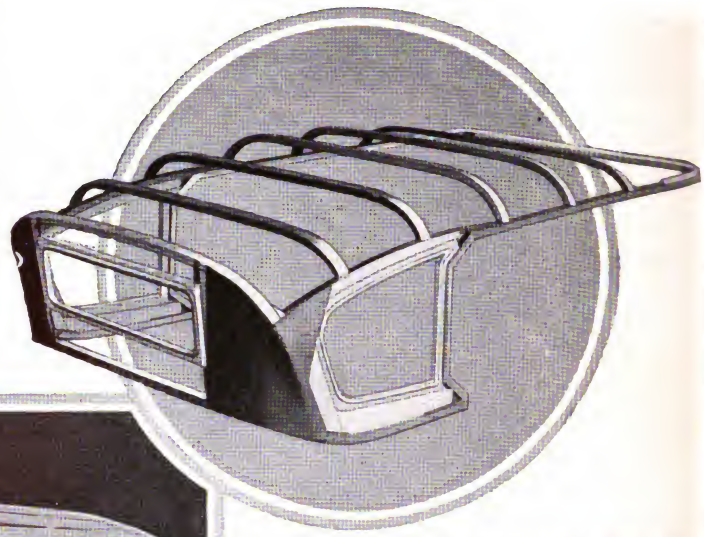
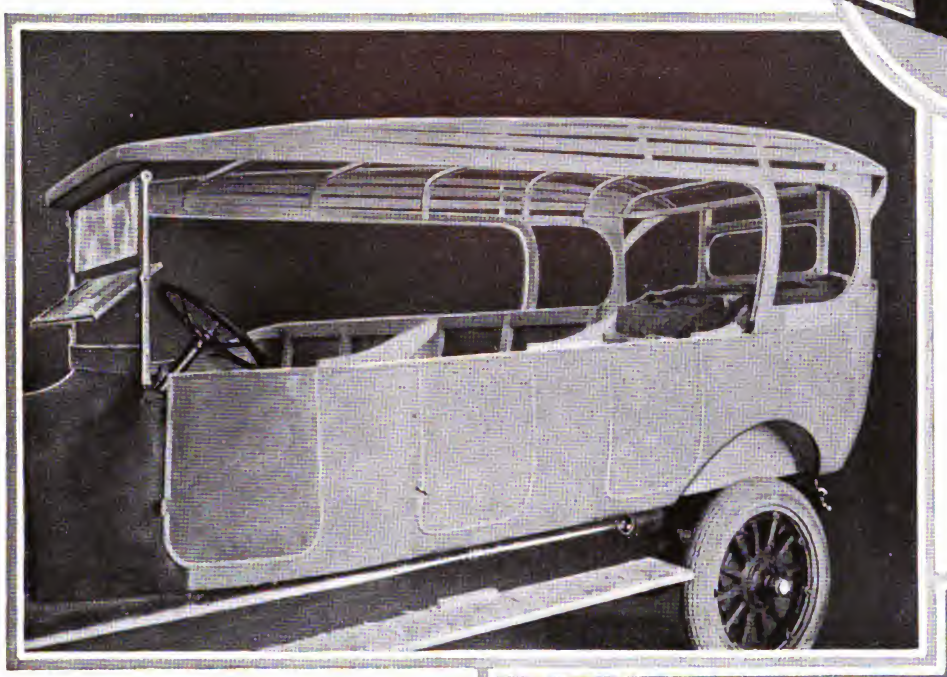
How Smartness Is Built Into the California Top

STANDING or rigid frame tops are generally considered as lacking in the elements of beauty and good taste which give the smart finish to a fine car. For this reason they are seldom found on high grade motor cars, with the single exception of the California top, so-called. This tailormade creation was originated in Los Angeles, but in its distinctive elegance and individuality is now available to eastern motorists since eastern body and top builders have learned how it is built. Once a beautiful curiosity on the New York or Philadelphia streets, the tailormade, or as it is more often called because of its place of origin, the California top is now seen in these and other cities with increasing frequency.



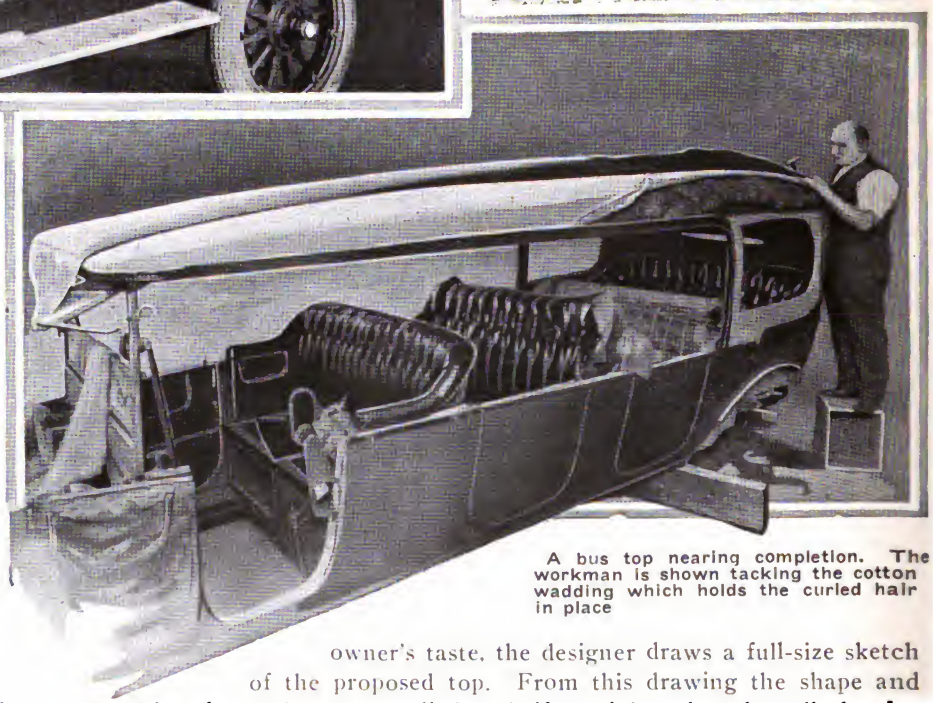
A touring car frame showing the back corners covered with sheet steel to stiffen the top and hold the padding in place



Sight-seeing bus body with California top before padding and covering fabric are put in place

There are no particular secrets about the construction which gives perfect symmetry and beauty to what was previously—at least as then constructed—considered a hideous thing. The illustrations on this and the following page give a splendid idea of the method of constructing one of these useful tops, which process can be described in detail as follows: The frame of the tailormade top may be compared to the skeleton of the human body. The padding, consisting of webbing, canvas, curled hair, etc., then becomes the muscles, and the outer covering of Fabrikoid or any similar fabric, the skin of that body. Unless the frame is symmetrical and strong there will be deformity and weakness instead of strength and beauty.

Hence, before any work is started on a top, a skilled designer must lay out the exact size and shape of the frame. This he does with the most careful attention to the size and to all details of the design of the car on which the new top is to be fitted. This car is first stripped of its former top and accurately measured. Then after thoroughly considering its particular shape and construction and the owner's taste, the designer draws a full-size sketch of the proposed top. From this drawing the shape and design are studied and, if need be, altered until the designer is satisfied that the finished top will conform to and emphasize with its smart shapeliness, the contour of the car body and make a pleasing combination therewith.



A bus top nearing completion. The workman is shown tacking the cotton wadding which holds the curled hair in place

The design ready, the various sections of the framework

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are cut out, bent, drilled, fitted and assembled. Straight-grained hickory, when available, is used for the ribs and front and back bows, but oak, ash and other flexible, strong woods are satisfactory. The body curve can be of maple or any tough, hard wood. The rigidity of the top being absolutely essential, the utmost care is exercised to make all joints solid and substantial. Wrought iron braces are used where necessary as well as knee-irons to hold the ribs. These are held fast by bolts and screws. No nails are used in automobile construction.

When the frame is ready it is securely anchored to the body by irons which are attached so as to give the utmost stability to the top. The anchorage must be so perfect that no vibration of the top will be noticed when the car is in rapid motion. The next step is to install the inside mountings of the top such as dome lights, mirrors and card cases. Then the lining is carefully tacked in position. This and all the subsequent steps of upholstering and trimming the top require considerable skill. The methods vary with different models and in different shops, but the object sought is always the same —a top that is distinctively graceful and that will always remain so.

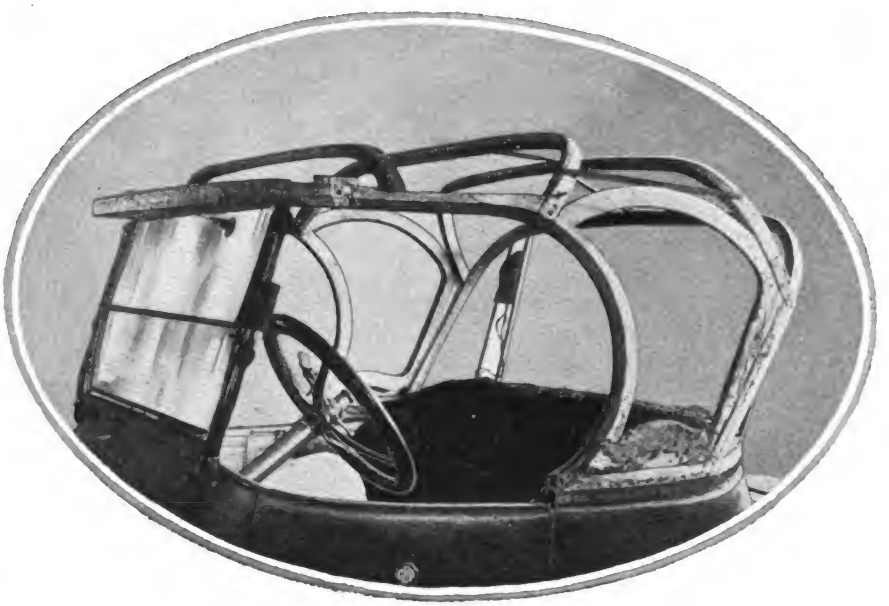
This result is almost always attained by the skillful application of materials of the best quality. Ordinarily the rigid wooden frame is first covered with heavy webbing, tightly stretched. Over this webbing a strong canvas cover is tacked. Upon it is spread a thick layer of curled hair. Layers of cotton wadding are laid upon this curled hair and the whole built up into the desired shape. This stuffing is covered with muslin to keep it in position, and the top is then ready for the outer covering. Often rear-side pieces of 28 gauge iron are tacked to the back of the top to keep the padding in place. Pads for the long sides of the top are sometimes made saparately and then fastened in place, in which case only the center of the top is webbed and the upholstery built upon this webbing to meet the side pads.

The outer covering of the top with the sides and back neatly sewed in and the bat wings at the back attached, is stretched into place over the upholstery and firmly fastened down. The nickel plated molding applied to the front and back of the top is held in place by wood screws on each end and by long prongs through the entire length. All nickel trimmings are plated on solid brass to eliminate any chance of rust. Instead of nickel trimmings a finer effect is usually obtainable by making a special molding covered with the same material as the top.

The inside of a rigid top of this type is usually very finely finished with some rich material that harmonizes with the color of the car. The most costly materials are practical for this work since there is no movement of the top to wrinkle or tear them, no sunlight to fade them and no possibility of the top leaking, if it is properly constructed and covered.

The covering material is of the utmost importance. Since on the tailormade rigid top there is no bending or flexing of the covering material whatever, it is apparent that what is most needed in such a material is chemical stability and immunity to deterioration from weathering. It must have the quality of keeping its strength and good appearance in spite of exposure.

In California it was quickly found that substitute leather, because of the coating, had this chemical stability to an almost absolute degree. It retained its flexibility and vitality, preserving its beauty after years of exposure to sun, rain, sand and alkali dust. It was not only water-proof but greaseproof and stainproof. Cleaning it was a sweet surprise, as all dirt brushed off or washed off with soap and water.



California top frame as fitted to Buick roadster

The great variety of solid and Moorish colors and the handsome, leather-like grains of substitute leather, making combinations to suit any owner's fancy, were added attractions. Some of the most rigid tops covered with this material are still in use in California and in perfect condition. Among the thousands of tailormade tops in California almost all are covered with substitute leather, so thoroughly has the material proven itself there.

Motor Training Schools Offer Opportunity

The war and the tremendous number of automotive vehicles which the various government departments had to have, has produced a situation now in which there is a shortage of skilled drivers and mechanics. To remedy this the army has launched into the field of vocational training and is now organizing schools to train men in the various branches of automobile repair, construction, and operation. They are real schools under trained teachers where the time of the pupil is wholly devoted to receiving instruction. Apart from the military necessity, the automotive industries will benefit by the establishment of this training system.

The United States Civil Service Commission is receiving applications to fill 150 positions of assistant instructor in motor transport training schools. The entrance salaries range from $1,800 to $2,400 a year. Detailed information may be obtained from the U. S. Civil Service Commission, Washington, D. C., or from the secretary of the U. S. Civil Service Board at the post office or custom house in any city.

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Carriage Builders Optimistic Over Future

At the 47th annual convention of the Carriage Builders' National Association, held in Chicago September 23 to 25, all the carriage and accessory men were unusually optimistic over the future of the carriage business, despite the inroads into it which motor cars have made. This was well worded in the report of the executive committee, which stated in part:

"The executive committee is pleased to report that, generally speaking, the industry is in a healthy condition. While the volume of business is less compared with some years ago, the volume during the past few years indicates that the industry is upon a substantial footing, with good prospects. Careful attention should be paid to service. In business service means the creative spirit, the search for profit in new fields of usefulness, rather than in taking ready-made business from competitors."

The association is making a survey of the field to discover, if possible, new opportunities. Walter J. Munroe, Detroit, who is in charge of the investigation, spoke briefly about it but did not disclose any details.

In his address, retiring president A. H. Ahlbrand, Seymour, Ind., indicated some of the advances in material costs since 1916. He gave the following list, with the comment that while labor advances have been equally large, now that so much assembling is done the labor item is not so large a factor:

Wheels	187	Turpentine	288
Shafts, dozen	137	White lead	46
Gear woods	120	Leather	208
Lumber	100	Rubber drill	190
Steel tire	78	Enameled goods	171
Bolts	118	Head lining	153
Fifth wheels	157	Body cloth	181
Forgings	111	Carpet	161
Springs	150	Sockets, rails and joints	133
Axles	210		
Linseed oil	185	Average advance	154

Among the notable addresses were those of C. E. Adams, Cleveland Hardware Co., Cleveland, on Steel; George B. Shepard, Eberhard Mfg. Co., Cleveland, on Hardware; and C. D. Fisher, Standard Wheel Co., Terre Haute, on Wheels.

Mr. Adams referred feelingly to the present attitude of labor toward its work and pay, and after going over the strike situation pretty thoroughly, said:

"I want to say one thing to you about the steel business that so far as prices are concerned your pig iron, bar iron, scrap, and all other steel products I believe today are the cheapest commodities there are, based upon the prices of leather, cloth and all the other different things that you buy to manufacture your lines. The U. S. Steel Corp. has had this thing ahead of them for some time, and in my humble opinion they have not wanted to raise prices because they did not want to have anything of that kind to deal with when this strike came on. Steel is the cheapest commodity today. It has got to be higher. Every single article in that line has got to be higher until we reach a time when there will be some great big catastrophe that will bring things to a standstill. The Ford Motor Co. have 48,000 men under one roof in Detroit; and the last thing we knew about it they were within three days of being out of some of their raw materials; and if this steel strike lasts long enough factories will begin turning people off at the rate of 5,000 or 10,000 at a time and we will probably see something happen then; so that I think that a man will make the most serious mistake that any man can make from now on for an indefinite time if he sells short on anything. In my opinion products of all kinds, food, clothing, steel, iron, all those products, no matter what you are paying for them, I believe they are cheaper now than they will be at any time during the next year. I believe that as truly as I stand here we are going to pay more for labor, we are going to pay more for machinery and for every single thing that we buy. I would not be one bit surprised to see the minimum day wage for common labor $10 a day. I thank you." (Applause).

Hickory and oak are still plentiful and cheap, according to Mr. Fisher, who said in part: "I believe that hickory and oak suitable for wheels are still plentiful and very reasonable, and I venture to say that if we attempted to buy ten acres of cheap land, prepare the same and plant with hickory and oak nuts, that the cost would be much greater than we can buy timber lands in the south which yield from 8,000 to 10,000 feet of hardwood and as much more of soft wood. This shows that the cost of timber is still below at what it can be produced, for it would take years and years before we could cut trees from the land we plant.

"You may say that if my statement is true why the present high cost of wheels and wheel material? Let me answer this by saying that the cost of timber, like the cost of coal, and like the cost of iron, is made up by the cost of labor that is put on the stock to put it in a marketable condition. Cutting of trees is triple of what it was before the war. Hay at $40 per ton and corn at $2 per bushel make feed high, and consequently the cost of hauling is more than triple. The timber usually is cut first along the railroads, and after that we must go farther and farther away from the railroads, which increases the cost, and, in fact, every operation necessary costs today triple, if not more, than it did a few years ago. It is not only that labor costs are double, but for reasons not easily explained it costs all manufacturers 50 per cent more today to produce an article, in addition to the wages being doubled. A set of wheels which we formerly produced for $1 per set costs us now $3 for labor, and just as long as present cost of living is maintained we cannot expect that wheels will be sold for less than they are sold today."

A plea for co-operation and the thought and investigation which will show new fields for carriage and harness manufacturers was the substance of Mr. Shepard's address. He began by stating that his interests were dual, that is as much with the wholesale harness manufacturers as with the carriage builders, but all of it dependent upon the use of the horse. He said in part: "A number of us who are vitally interested in the future of the horse have come to feel latterly that some phases of the future outlook are beginning to become a little clearer in outline than they were, and that the point has been reached where the economic use of the tractor and other motor-driven vehicles in connection with farm and agricultural work may be more clearly defined. It is apparent that their economic use is limited and that there is probably, humanly speaking, a definite and permanent use of the horse in connection with the farm and communication between farms. Curiously enough, that opinion is justified by the fact that some of the more conservative, wiser and more

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successful manufacturers of motor trucks are beginning to feel that their own investment is threatened by the efforts of some of their less conservative competitors to sell their product where it should not be sold; the idea being that the pushing of sales for the sake of making sales without regard to the need for and value of the article to the man who is buying is ultimately going to hurt their business, and there is a pretty definite movement taking shape among those manufacturers today to counteract that tendency and to say, 'Hands off.' There have been certain steps taken in that line. Now with such a condition existing it does seem as though the time had arrived when those of us who are interested in the future use of the horse might take intelligent and effective action. In having that under consideration we have been surprised to find how many interests there were identical with ours and to find that the same thought had become active in their minds also.

"We hope to be able to get facts which will be effective and to place them before the agricultural community in ways equally effective; not with the idea of getting any man to throw away his tractor or his truck, or anything of that sort which he already possesses, but with the idea of accelerating his thinking a little bit. I think we are all pretty well agreed that a great many men are likely to learn by experience in the next few years that the tractor and the truck have their limitations, and that they are going to cost more than they are worth; but if instead of sitting back and letting them buy that experience unaided, we enable them to save the money that they would spend in acquiring that experience in the purchase of trucks and other things that the horse can do better for them, it will be better for all of us."

The convention adopted two resolutions: One endorsed the course taken by E. H. Gary, U. S. Steel Corp., in the steel strike, and pledged him the association's support. A telegram to that effect was sent to Mr. Gary. The second resolution advocated the return of the railroads to private ownership as soon as practicable, and vigorously condemned the Plumb plan of railroad control.

In view of the long and faithful service of Harry C. McLear as secretary-treasurer, he was elected an honorary member of the association for life, and was voted a pension equal to his annual salary.

Frank H. Delker, of Henderson, Ky., was chosen president of the association, and George W. Huston, publisher of the Spokesman, Cincinnati, secretary-treasurer.

For members of the executive committee the following were chosen: C. R. Crawford, St. Louis; Clem Perrine, Cincinnati; P. E. Ebrenz, St. Louis; R. S. Triplet, Owensboro, Ky.; A. H. Ahlbrand, Seymour, Ind. Vice-presidents were elected as follows: A. T. Jackson, Rockford, Ill.; J. A. Evans, Griffin, Ga.; John Gummer, Elkhart, Ind.; W. T. Shaver, Des Moines, Ia.; Gale B. Smith, Henderson, Ky.; C. C. Bradley, Syracuse, N. Y.; George M. Hoffman, St. Louis, Mo.; N. H. Cannady, Oxford, N. C.; George Gerstenslager, Wooster, O.; August Geissel, Philadelphia, Pa.; T. M. Robinson, Nashville, Tenn.; Ed. E. Hughes, Lynchburg, Va.

The selection of the location of the convention city for 1920 was referred to the executive committee, with power. Th se citie sent invitations: Meplewood, N. H.; St. Joseph, Mo.; Washington, D. C.; Buffalo, N. Y.; Columbus, O.; Chattanooga, Tenn.; Cincinnati, O.; St. Louis, Mo.

Forest Conservation a Live Topic

At the tri-state public conference held in Indianapolis, October 22-23, by representatives of the states of Ohio, Indiana and Illinois and the wood using industries of those states, one of the most discussed topics was that of the present need for forest conservation.

Representatives of the Forest Service, United States Department of Agriculture, emphasized the need of greater conservation of private forest resources throughout the country, and the conference considered particularly what remedial measures are practicable in the three states named. The time is not far distant, according to the foresters, when wood users in many sections of the country will be compelled to draw on forests more than half way across the continent for their raw materials, and it is believed that the transportation charges under such conditions will be almost prohibitive.

If it means anything, this means that other materials will have to be employed in place of wood or else wood used more sparingly.

Manufacturers Permitted to Inspect German Trucks

The Motor Transport Corps, through Gen. Charles B. Drake, in charge, have arranged to allow all interested manufacturers and their accredited representatives, as well as all engineering associations or societies, to inspect the German motor trucks at Washington, D. C., where they have been moved recently from Camp Holabird, Md. The Transport Corps itself, with the assistance of the automotive associations, have made such an inspection. The trucks were brought to this country for the purpose of aiding the motor truck industry as a whole, as well as the War Department, and it is understood that all the government information and data collected from this survey, will be available later on to the automotive manufacturers. The trucks, which number about 50, will not be disassembled until after the general survey has been completed, and a time limit of October 15 has been set upon this.

August Tampico Oil Shipments Very Heavy

In the month of August the declared exports of crude oil and petroleum products from the Tampico district were the heaviest of any of the recent months. The total shipped to the United States consisted of 5,989,518 barrels of 42 gallons each. Shipments to all other points totalled 1,759,598 barrels. Of the latter, only 432,805 barrels were shipped outside of this continent, all of this going to England, Scotland and Egypt.

In 1917 the average monthly shipments were 4,600,000 barrels, and in 1918 5,500,000 barrels, so that August shows almost 10 per cent increase over previous averages.

Fords Now Own All Ford Co. Stock

Through a deal recently concluded in Detroit, James Couzens, former general manager of the Ford Motor Co., and now mayor of Detroit, has sold to Henry and Edsel Ford his 2,180 shares of stock in the company at a price said to be $29,500,000, or more than $13,500 per share. The stock originally cost him about $2,500. By its purchase Henry Ford and his son, who is now its active head, become sole owners of the Ford properties.

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Design of Sight-Seeing Bodies

The most popular type of sightseeing body, or char-a-bancs (plural chars-a-bancs) as the English call them, is the one seating 25 or rather 24 besides the driver, on five cross seats for five persons each, but the English type with six cross seats is rapidly gaining favor.

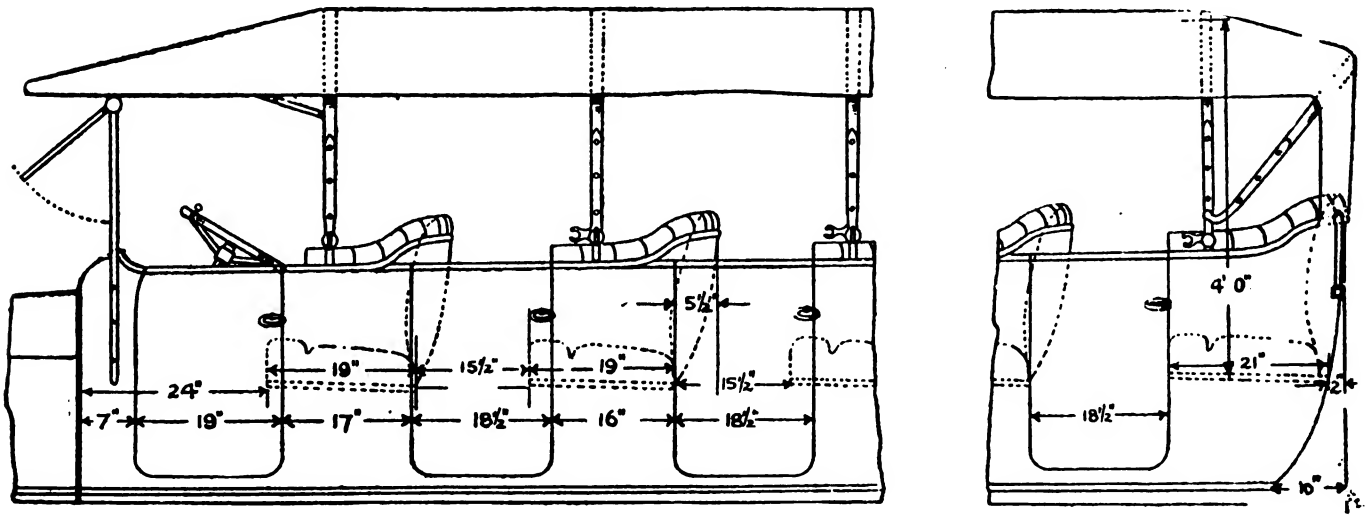
In England the 30 seater has easily been the most popular type demanded this season, and large numbers of orders have already been placed for next season's delivery for similar patterns. The wheel base of the chassis used vary from 14 ft. to 14 ft. 6 in. (168 to 174 in.), of which 11 ft. to 11 ft. 6 in. is behind the dashboard, and it is the aim of the designer to arrange the doorways so that the wheelhouse is as near as possible centrally placed between the fourth and fifth doorways. With most makes of chassis the wheelhouse has to be from 6 in. to 8 in. in depth, and from 12 to 15 in. wide, unless the body is mounted on runners of unusual depth. In some cases by using a 4 in. bearer immediately under the bottom framing it is possible to dispense with the wheelhouse.

The Tank and Its Bearing on the Design

It is sometimes wondered if the motor engineer always realizes how the height of the fuel tank often influences the whole design of body. One well known maker is able to fit a tank which is 16¾ in. above the frame, under which conditions, it is presumed, that the carbureter is fed successfully even in a hilly district, so that one cannot quite understand why another maker should require a further 3 in. in order to carry out a similar idea. Three inches extra height of a front seat is a considerable amount when one requires to make each successive row of seats an inch higher than the one in front; while excess of height tends to defeat any attempt to introduce new and flowing lines into the body. Also the designer may wish to give extra comfort by giving more leg and knee room, adding to the depth of the cushion, increasing the width of seat, and so on; but these refinements are usually accompanied by lowering the seat. It would certainly look odd if all the seats, other than the driving seat, were made low and comfortable, while the front seat was allowed to remain its normal height. Probably the effect of an insistent demand for more luxury in chars-a-bancs, and the presence on the market of improved fuel-feeding systems, will lead to the alteration of the design of the tank. It is quite likely that a smaller tank will be used under the front seat, with an auxiliary tank under the scuttle dash or the second row of seats. The making of a special tank to suit a certain job is often carried out in private car work, and since it is not an expensive matter, it is certain to follow sooner or later with public service vehicles.

The Length of the Body

The distance from the dashboard to the back edge of the steering wheel averages about 2 ft., or if it is a little more than this it is usually possible to place the front edge of the driving seat that distance from the dashboard. The seat board from front to back will measure about 19 in., while the knee room, measured horizontally from the back of one seat to the front of the next, is normally about 15½ in. With the back seat the distance from back to front is increased a little owing to the shape of the turnunder, so that 21 in. is often allowed for this, while the knee room can be increased to the full width of the door. Adding together 24 in. from dash to front seat, five seats each 19 in. wide, a sixth 21 in. wide, four lots of knee room each 15½ in., and one of 18½ in. for the back seat, one obtains an overall dimension on the seat line of 18 ft. 4½ in. Allowing 8 in. turnunder from seat to bottom, it will be seen that the chassis should measure about 17 ft. 9 in. behind the dash in order to mount a 30 seater body of normal comfort. On referring to the diagram it will be noted that the front doors are 19 in. wide and the other doors 18½ in. As the seat encroaches on the doorway some 3 in. on one side, while the sail-out of the back panel takes up 5½ in. on the other side, only about 10 in. actual clear gangway is left. The knee room when seated is sufficient, but the getting in and out of the body is hardly a comfortable operation. One simple method of getting over the gangway difficulty is to have only one side entrance, and then arrange pairs of seats with a central gangway, as in a single-deck omnibus. It will be found that it is possible, within an inch or two, to arrange for the same seating capacity as in a usual type of body, with the advantage that each passenger can get to his seat with comparative ease, while at the same time it is possible to design a stronger and lighter body and one that is cheaper to construct. In a body design previously presented it was shown that for cross seats all facing forward, 24 passengers, or 12 seats, each holding two, a length of 13 ft. 1 in. would be required. Add to this 3 ft. 8 in. for the distance from dashboard to the back of the driving seat, and 24 in. for a single side entrance immediately be-



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hind the driving seat, and one obtains an overall length on the seat line of 18 ft. 9 in., or 4½ more than is necessary, with side entrances to each seat. The hind seat can, of course, be carried right across the body, so that there are five pairs of seats each holding two, and a front and rear seat for five each, making a total capacity of 30 as before. As a single entrance is considered satisfactory for an omnibus which usually caters for traffic entailing a fairly frequent number of entrances and exits by the passengers during a journey, it is difficult to understand why a char-a-bancs should require more consideration for the passenger in this direction, seeing that he usually goes the full length of the journey. The chief saving with a single doorway is in the knee room between the seats. In an ordinary char-a-bancs the usual dimension from one seat back to the next is about 2 ft. 10 in., whereas in the 'bus seating referred to above, 2 ft. 1 in. is all that is necessary, provided the garden type of seat is adopted.—Automobile and Carriage Builders' Journal [London].

Carriage Catalogs Wanted

In Alden, Djibouti, and some other parts of the Red Sea commercial district, there are a number of old American carriages in use. Most of these vehicles are several years old and some owners have indicated an interest which may possibly result in the purchase of new ones. There was no chance to import carriages from America during the war, mainly because of the lack of shipping and very high freight rates. With the return of normal conditions and the reopening of the Clan, Ellerman, and Bucknall freight service from New York to Indian ports, via Aden, it is possible that some carriages can be sold. In order further to develop this possibility this consulate (at Aden, Arabia) would like to have duplicate catalogs of light carriages built to be drawn by one horse.

It is believed that quotations on freight from New York to Aden can now be obtained, and if this is the circumstance it would probably be possible, and it would be advisable, to quote c. i. f. prices. There would be no customs charges on carriages imported into Aden.

New Method Dries Panels Without Surface Checks

If panels are overdried their tendency toward warping and twisting is generally increased. The lower the moisture content the more the warp. The short time required for drying panels varying from a few hours for thin panels to a few days for thick ones, makes it impracticable to make actual determinations of moisture content to decide when the material has reached the desired dryness.

An automatic method of insuring the proper moisture content in dried panels is proposed by the Forest Products Laboratory. This is what may be called the "maximum humidity method," in which the relative humidity of the air in the kiln or drying room is regulated so as to remain at the highest level which will permit the wood to dry to the desired degree (and no further) in a reasonable length of time. By this method checking of face veneer is also prevented.

The maximum humidity method lends itself to the most convenient and economical handling of the panel drying operation. As there is little danger of over drying, the stock may be left in the drying chamber for any reasonable length of time beyond the minimum required. Thus thin panels and thick panels may be taken from the press and placed in the kiln at the same time, and removed at the same time, even though the thin panels dried much quicker.

For panels made up of normally dry veneer, a kiln temperature of 120 deg. F. throughout the drying period is a good schedule to follow. If with this temperature the humidity is maintained at 46 per cent, the panels will come uniformly to a final moisture content of about 8 per cent within a reasonable drying period. If the same temperature is used and the humidity is maintained at 57 per cent, the panels will not dry appreciably below 10 per cent.

Coatings That Prevent End Checking

Wood, whether in the form of logs, lumber, timber, shaped blanks, or veneer, will split and check at the ends during seasoning, if drying is allowed to go on at a natural rate through the end grain. To retard the rate of drying from the ends it is necessary to cover them with some protective coating.

The law of end coatings, in simple terms, is that the harder and greener the wood the more effective must be the coating. In its experiments to determine the practicability of various coatings and end dips, the Forest Products Laboratory found the following to be true:

Paint is convenient to handle, but is of low effectiveness.

White lead is convenient to handle, and is of medium effectiveness.

Lorac, a commercial compound, is convenient to handle, and is of considerable effectiveness.

Rosin-lampblack is inconvenient to handle, but is of high effectiveness.

Rosin-lampblack is made according to the following formula. Clear grade rosin, 60 parts by weight; lampblack, one part by weight. The rosin should be melted but not allowed to boil or froth. The lampblack should then be thoroughly stirred in. The ends of the sticks should be dipped in this molten mixture to a distance of about ½ in. When hard the coating should be smooth, free from bubbles, shiny, and an eighth of an inch thick over the end.

If the stock is to be subjected to rough handling which might cause the coating to chip when cool, linseed oil may be added, in the proportion of 1 to 15 by weight, but this will have a tendency to make the coating excessively soft in the kiln at temperatures above 130 deg. F.

American Tractors Do Well in New Zealand

The Darfield branch of the New Zealand Farmers' Union recently arranged a trial of agricultural tractors in which American machines made a fine showing. Robert Reid, president of the association, superintended the demonstration, and plowing, cultivating, and fuel consumption were carefully watched. Six tractors took part in the trial: two Clevelands, of 12-20 h.p.; one Fordson, of 10-20 h.p.; one Sandusky, of 10-20 h.p.; one Parrett, of 12-25 h.p., and a "Mak-a-tractor," or ordinary 20 h.p. Ford car adapted for haulage purposes. The last-mentioned operated a double-furrow plow, but all the others were harnessed to three-furrow implements. According to the conditions, each outfit had to work for seven hours. The furrows had to be more than 6½ in. in depth and 10½ to 12½ in. in width. In all cases the work was excellently done.

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The Electric Arc Welding Process

A Description of the Function and Practical Operation of Some Types of Equipment for This Work—Special Machinery for Special Work

By H. L. UNLAND*

WELDING by means of an electric arc, or arc welding as it is commonly known, has been brought to such a state that it is now adaptable to practically all applications when iron or steel are to be joined, built or cut.

This process utilizes the heat of an electric arc formed between the electrode and the object on which the work is to be done. The piece of work to be welded is connected to one terminal of the electric circuit and the electrode to the opposite terminal. When the electrode is touched to the work and withdrawn the proper distance, an arc is formed which the operator maintains by manipulation of the electrode holder. The arc melts a small pool of metal on the work and in welding or building up the additional metal is deposited in this pool in a molten state thereby forming a firm union between the new and old metal.

The principal advantage of the electric arc welding process is that large amounts of energy are transformed into heat in a very small space. The heat is confined to the immediate locality of the weld and accordingly does not spread out over the adjacent space. This reduces materially the expansion and contraction troubles, and at the same time results in a high heat efficiency. A further result of the great concentration of heat is to produce a very high temperature which is sufficient to fuse immediately the metal which it is desired to weld. It is not necessary in starting a weld on steel to preheat or to wait until the metal can be brought in the fusing temperature.

Practically all arc welding is accomplished by two methods commonly referred to as either the metallic or the carbon electrode methods.

In the metallic electrode method the electrode consists of a wire or rod held in a suitable holder. The heat of the arc in addition to melting a small pool on the work, melts the electrode away and the current causes the molten metal to be driven in finely divided particles against the work. In this manner additional metal is built on or used to join two pieces of metal. By this method metal can be deposited on vertical surfaces and it is the only way in which metal can be successfully deposited overhead.

The metal deposited by this method is more uniform and the weld is stronger and has a smoother and more regular appearance than one made by the carbon electrode. For these reasons the metallic electrode is used when strength or appearance is important.

The carbon electrode method is used for building up metal, plugging holes in castings, welding, and joining parts where strength and appearance are not essential or where the surface is to be machined off. Since heavy currents can be used, metal can be built on with great rapidity, and where speed is desirable this method is applicable.

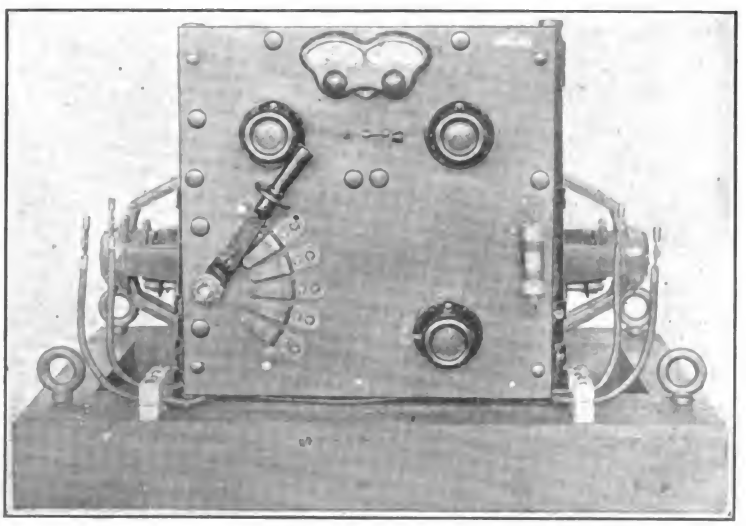
In the carbon electrode method a carbon rod is substituted for the metal electrode. The arc fuses the metal of the work and additional metal is built on by melting from a rod of filling material in a manner similar to soldering with an iron or welding with a gas torch.

For cutting, or melting away excess stock, the carbon electrode is used. In cutting the arc is held stationary at a point on the work where the metal as fused is free to flow or run off. As the molten metal runs away the arc is advanced and in this way a cut is made through the piece.

Welds which are soft enough to be machined can be made by using either method if reasonable care is taken. The deposited metal should not be chilled and if the carbon electrode is used the arc should be kept long enough to prevent carbon being carried into the weld. Other than the above causes, hard welds are usually due to poor quality of electrode metal or filling metal.

The deposited metal is obviously cast steel, since it is

* Power and Mining Engineering Dept., General Electric Co.



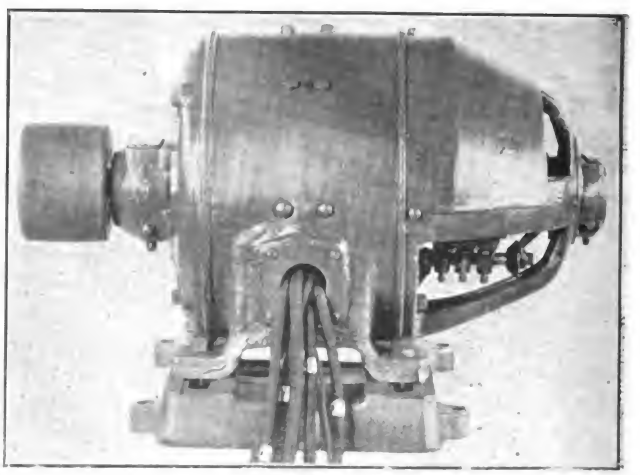


Fig. 1—Constant energy arc welding set for metallic welding. One man portable outfit
Fig. 2—Compound generator designed to produce 4 KW at 1,700 r.p.m.

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merely fused in place and is not ordinarily subjected to any mechanical working afterward. The metal will have the coarse crystal structure found in unannealed cast steel and likewise will have comparatively low values for reduction in areas and elongation when tested. In some cases the tensile strength of the metal in the weld may be as high as 55,000 to 60,000 lbs. A safe figure is 35,000 lbs. where the work is done by experienced welders.

The Wirt Jones tests of the research subcommittee on arc welding of the Emergency Fleet Corp., as reported in a paper before the A. I. E. F., show a range in tensile strength of 38,600 to 62,600 lbs. per sq. in. in welds made by direct current bare electrode, arc welding. These welds were machined down to the same thickness as the plate before the tests were made. The elongation found varied from 4 to 13 per cent. The amount of power required for welding depends largely upon the source of supply.

The following table shows the approximate kilowatt input required for various systems:

	KW or Kv-A
A. C. 100 volt supply	15
75 volt constant potential	15
60 volt constant potential	12
A. C. 110 volt supply	7
40 volt constant potential	8
Constant energy equipment with supply motor-generator set	7.65
Constant energy equipment operating from 125 volt line	5.35

Should any considerable number of operators be employed it will become at once apparent that the outfit requiring low input is very much to be desired, as the cost of operation is reduced by such a large amount.

Types of Equipment

There are several principal types of welding equipment among which are:

1. Constant energy, self excited generator.
2. Constant energy balancer sets.
3. Constant potential generator with auxiliary equipment.
4. Alternating current welder.

All except the constant potential type are primarily single operator individual equipment suitable for bare metallic electrode welding only. The constant potential type may be used as a single operator equipment for either carbon or metallic electrode welding or a number of operators may work from one machine. This type of machine also permits the use of the carbon electrode for cutting.

The equipment for each type of apparatus may be outlined as follows:

The constant energy self excited generator is arranged for belt drive to be directly connected to direct current motor or to 60 cycle 3 phase alternating current motor.

This type may also be direct connected to 25 or 50 cycle alternating current motors or to alternating current motors of any of these frequencies wound for two phase circuits, the maximum voltage being 550. It can also be direct connected to gasoline engines or to other engines or speeds of either 1,200 or 1,500 r.p.m.

The constant energy balancer sets are suitable only when 110 to 125 volt d. c. is available. If the circuit has the positive side grounded it is entirely satisfactory. If not, special precaution must be taken.

The constant potential generators can be direct connected to direct current motors or to a 60 cycle 3 phase alternating current motor. The equipment is also suitable for connection to gas, gasoline, oil or steam engines.

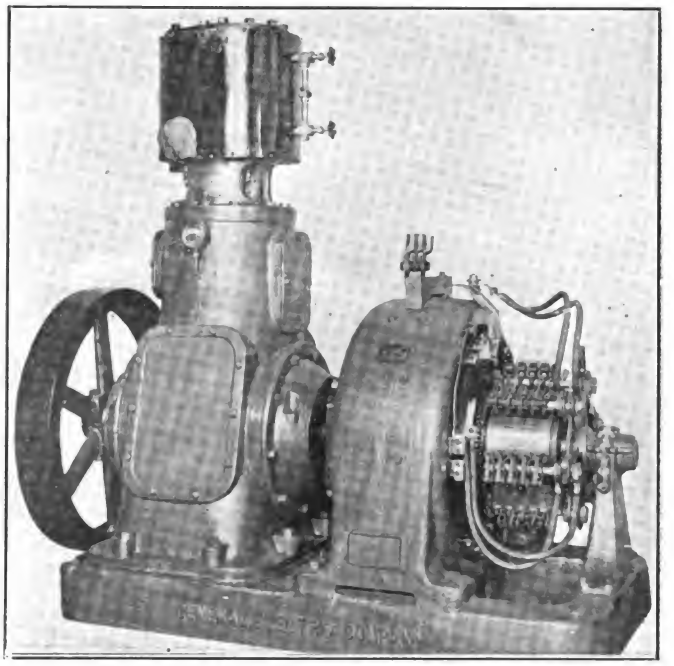

Fig. 3—Marine engine with forced lubrication direct connected to 60/60 V. generator for arc welding

Alternating current welders may be used on 60 cycle circuits of 220, 440 or 550 volts maximum. The welder is single phase but where several are in use on a poly-phase system, they may be distributed among the phases to partially balance the load.

The constant energy arc welding generators of the self excited type are designed to obtain in one machine all the characteristics demanded by arc welding service. This is obtained without the use of external ballast resistance or separate excitation from any external source. Since the machine provides its own excitation the voltage characteristics are such that throughout the proper working range of the arc the energy delivered is practically constant. The voltage and current follow the momentary variation in the arc conditions practically instantaneously, and consequently the lag between change in arc conditions and resulting corrective change in electrical conditions is reduced to a minimum. This lag is one cause of trouble in welding with self-regulating welding equipment whether the automatic feature is embodied in the revolving apparatus or mounted on the control panel.

The generator is so wound as to give a no load or striking voltage of 60 which automatically decreases to the voltage required by the arc when struck. This is from 18 to 20 for the average operator and average good work. A longer arc is undesirable since poor work is liable to result. Skilled operators on smooth work are sometimes able to hold a very short arc with a voltage as low as 16, but in rating the generator the value of 20 is used. By adjustment of the dial switch on the panel, as shown in Fig. 1, the current may be adjusted from a maximum of 200 to a minimum of 75 in 25 ampere steps.

Belt driven generators are mounted on standard sliding bases, and the control panel is arranged for separate mounting. The generator is shown in Fig. 2.

The standard motor generator sets are assembled com-

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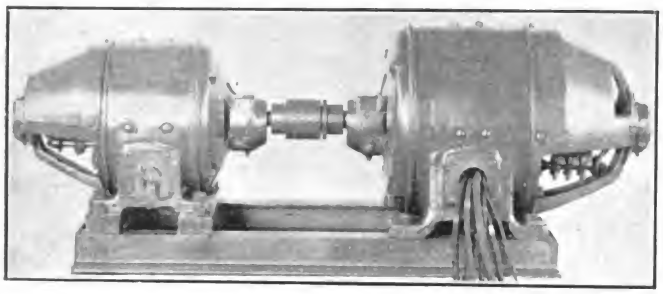

Fig. 4—Compound generator (4 KW at 1,700 r.p.m., 60/20 V.) driven by shunt motor (7½ h.p., 1,700 r.p.m., 230 V.) for welding uses

plete with the switchboard on a structural steel base so the entire equipment may be picked up by a crane and handled as a unit.

The connections are simple. Motor leads are brought out at one end and welding leads at the other. It is only necessary to bolt on the required length of cable.

The motor generator control panel has mounted on it motor starter with fuses, generator field rheostat, generator voltmeter, generator series field dial switch.

The constant energy arc welding set of the balancer type is a novel type of arc welding equipment which combines the best electrical characteristics for the arc with high efficiency and light weight.

It operates from a 125 volt direct current supply circuit, but will also operate on voltages as low as 110.

A supply voltage of 125 was selected because that was found to give the best results, not only from the standpoint of efficiency, size and weight for the set, but from the standpoint of the distributing system. These characteristics have been demonstrated both from a series of practical tests under commercial operating conditions and from oscillograph curves.

The balancer set is of standard two-bearing construction, built for operation on 110 to 125 volt direct current supply circuits. The two armatures are mounted on one shaft and connected in series across the 125 volt supply circuit. One terminal of the welding circuit is taken from the connection between the two armatures and the other from the positive line. By this means each of the machines supplies part of the welding current and, consequently, the size and weight of the machines are minimized. The design of the fields and their connections is such that the set delivers the voltage required directly to the arc without the use of resistors or other energy consuming devices.

The welding control panel for the balancer set consists of a slate base 24 in. square, which is mounted on 24 in. pipe supports for portable work and on 64 in. pipe supports for stationary work. The equipment consists of: One ammeter, one voltmeter, one dial switch, two field rheostats (for motor and generators), one starting equipment with fuse, one reactor mounted on the pipe frame work of panel.

The ammeter and voltmeter are enclosed in a common case. The ammeter indicates current in the welding circuit and the voltmeter is so connected that by means of a double-throw switch either the supply line voltage or the welding line voltage can be read.

The dial switch is connected to taps in the series field of the generator, the field being connected to oppose the main field. This feature provides the current control by which six steps are obtained of the approximate values 50, 70, 90, 110, 130 and 150 amperes, which enables the operator to cover a wide range. If intermediate current values are required they can be obtained by means of the generator field rheostat.

A small reactor is used to steady the arc and current both on starting and during the period of welding.

Arc welding is usually done on metal which is grounded and this is unavoidable in ship work where the ship structure would always be well grounded. Since successful operation requires that the positive terminal be connected to the work the supply circuit should be arranged so that it can be safely grounded on the positive side.

In the constant potential arc welding generators any

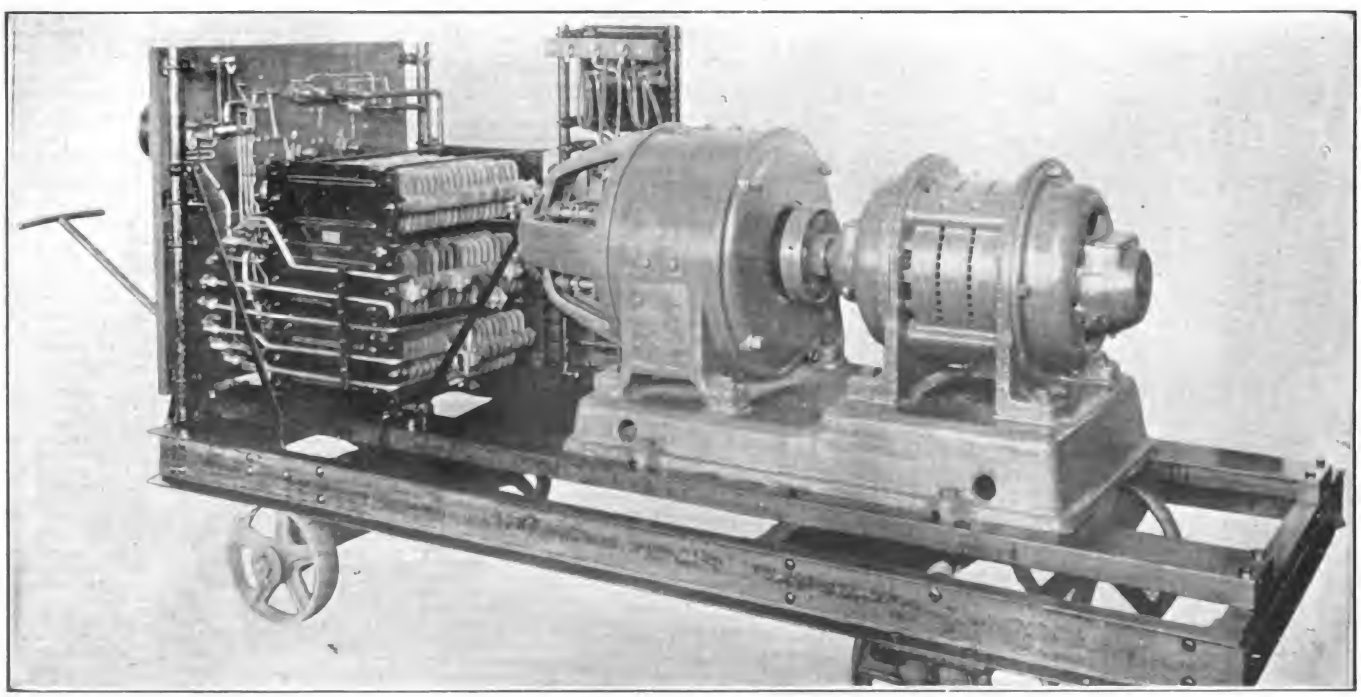

Fig. 5—Portable arc welding set, consisting of welding and generator panel, connections, and starting compensator, on light steel truck with wheels

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direct current can be used for welding, but the voltage must be reduced to values from 20 to 50 volts. One method of obtaining this condition is by using a constant potential supply circuit and inserting resistance in series with the arc to absorb the excess voltage. This is plainly a very inefficient method of operation with the ordinary supply circuits as the voltage absorbed by the rheostats is a large part of the total energy. If the supply circuit is 250 volts and the carbon arc requires 50 volts, it is obvious that four-fifths of the energy taken from the mains is wasted in the rheostat. If now the supply circuit is 550 volts and the metallic arc is being used at 20 volts the energy used is only a very small fraction of the energy taken from the line.

In order to avoid these losses the General Electric Co. has developed a line of special low voltage generators and a method of control, as described and illustrated herewith.

The generator is wound for a voltage of from 60 to 75 volts and in no case is it necessary to have a generator of higher voltage than this for welding.

The control equipment consists of a main generator panel with or without a welding control circuit, with a separate auxiliary panel for each operator. In addition there is in series with the arc a grid rheostat for varying the current by means of the dial switch shown on the panels, connected to taps in the rheostat.

Method of Operation

The automatic control equipment gives thorough protection to the generator without affecting other operators whose welding circuits may be connected to the same generator. This equipment consists of a protective relay controlling a shunt contactor in the welding circuit. The relay is provided with an oil dashpot and therefore will not operate on momentary fluctuations of current.

The setting of the dial switch on the welding panel determines the amount of resistance in series with the arc and therefore controls the current used. This is regulated as required by the work to be done.

Before starting the arc the operator sets the dial switch for the amount of current required for the work so that on starting the circuits are in normal running position. Thus there is no necessity for having any relays or switches open or close or in any way change or disturb the electrical circuit in order to weld.

If, however, the operator leaves the electrode in contact with the work too long or takes too much current after having drawn the arc, the protective relay opens the exciting coil of the contactor which in turn opens the welding circuit. In order to resume operations it is necessary only for the operator to lift the electrode, thereby breaking the circuit, whereupon the relay drops out, closing the contactor and restoring the circuits to the normal operating condition. This system gives complete protection to the generator and assists the operator by making it unnecessary for him to leave his work to close the circuit breaker after it has opened due to overload. Other operators, whose welding circuits are connected to the same generator, are not involved in any way since this protection affects only the circuit in trouble. In case of an extremely heavy load or a severe short circuit in the cables the circuit breakers on the main panel will open the generator circuit.

Where carbon electrode work is to be done light work can be welded using 150 to 250 amperes. Medium welding

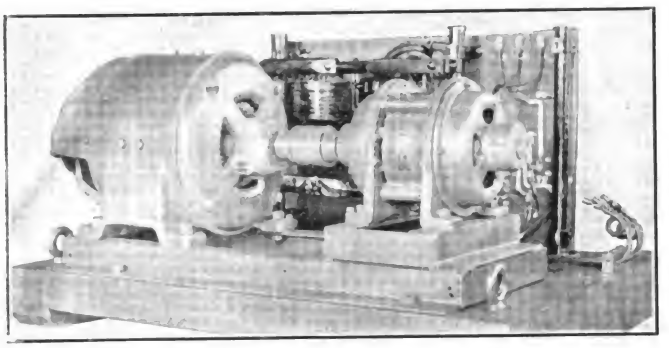

Fig. 6—200-ampere compound arc welding generator (4 KW, 1,700 r.p.m., 60/20 V.), driven by 7½ h.p. motor (1,800 r.p.m., 60 cycle, 440 V.) with control panels mounted on wooden skids

by this process requires from 250 to 350 amperes and heavy welding will require 400 to 600 amperes. Where cutting is to be done by the carbon arc the capacity of the set depends on the cutting speed required. For light metal and where speed is not important 300 amperes is sufficient, but where the metal is 2 in. thick or more, it is desirable to use heavier currents and for this purpose up to 1,000 amps. can be used.

Alternating current arc welding equipment has been developed to use alternating current in the arc. It consists of a single-phase transformer provided with taps and connections for obtaining the various values of current and proper voltage required by the bare metallic electrode arc as used in welding.

The equipment operates on a 60 cycle circuit and with supply voltages of 550 or less.

The taps in the transformer winding are connected to terminals on a small switching panel where the proper connections are made by means of a simple plug switch. Four leads are brought out of the case, two of which are for connection to the supply lines and two for the welding circuit. These leads are provided with terminals to facilitate connecting to the external lines.

The transformer with its panel is supported in a rugged wooden box. The mounting is such that by removing four nuts the entire equipment can be removed from the box as one part. This facilitates inspection and cleaning. The front panel of the box covers the switch panel and is provided with openings through which the plug switch can be inserted in making the connections. It is thus impossible for the operator to come in contact with any of the electrical parts accidentally. This construction also protects the switch panel from accidental short circuit and from damage by being struck.

This mounting of the equipment in the box is so arranged that definite air channels of suitable size are provided for the circulation of air by the draft due to the heating of the transformers. The openings are so arranged that it is practically impossible for foreign bodies to enter the box accidentally and damage the equipment.

The box is approximately 24 in. long by 18 in. wide by 20 in. high overall and the total net weight is approximately 350 lbs. Eye bolts are provided for lifting by a crane or a rod can be put through the eye bolt in case it is desired to move the equipment by hand. The box rests on heavy wooden skids so the equipment can be dragged about if required without injury.

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Vol. LXI OCTOBER, 1919 No. 7

Wage Advances Lower Efficiency

WHATEVER else can be said for the great bodies of men all over the country who are striking for more money and shorter hours, it certainly is a provable fact that the wage increases of the last few years instead of increasing efficiency and producing more work per man have had the opposite effect. That is to say, the higher the wage has become the lower the amount of work per man.

In some figures compiled by the U. S. Steel Corp. giving wages, number of employes and tonnage of steel, the outstanding fact is that the average production per man has gone steadily downward from 62 tons a year in 1915 to 52 tons in 1918. The average wage in this period has gone steadily upward, from $925 in 1915 to $1,950 in December, 1918. Translated into percentages, these figures show that for 110.8 per cent more money the production was reduced 16.1 per cent.

Republic Steel shows the same thing. In 1915, 11,105 workers produced 1,033,400 tons of steel at an average pay of [illegible]1, this being 93 tons average. In 1918, 14,668 workers (3,563 more), although averaging $1,619, an increase of 110 per cent per man, turned out only 1,024,000 tons, a decrease of 9,400 tons.

Tractor Horsepower Ratings

ONE of the things to be guarded against most carefully in exporting American goods is overstatement relative to the goods. This has a particular point at this time in that the world is about to buy tremendous numbers of American tractors, and will use them under widely varying conditions and with wide variations of care and repair, and naturally, also, of results. If we can provide in advance against overstatements of what the tractors will do we will have accomplished something worth while.

At present tractor ratings are figured according to the so-called S. A. E. formula, which gives the tractor a rating of 80 per cent of what it does in a two-hour test, this referring to both drawbar and belt performance. Thus, if a tractor develops 20 horsepower on test, its permissible rating would be 80 per cent of this, or 16. Apparently this method gives a margin of safety of 25 per cent, but actually it does not work out that way. In some tests conducted by one large western university, not a single tractor developed more than 18 per cent of its advertised rating, which was supposed to be based on the two-hour test and the S. A. E. formula. Obviously, the deduction from this is that the formula rates tractors too high, that is, that the two-hour test will give a result which the tractor can not approximate in practice, hour after hour and day after day. If this is the case, the method of rating should be changed; perhaps the percentage should be reduced to 60 or even 50.

In such reconstruction of rating practice we have no axe to grind when we say that the best formula will be the most modest one, that is, the one which will give the tractor the lowest rating relative to its actual demonstrable ability. Any formula or rating process based on piston displacement or weight will not satisfy; what is wanted is a modest measure of the power, and the ultimate rating method must not have a power rating basis.

The Printing Situation

IT was extremely unfortunate that the printing strike in New York, which has tied up the majority of the trade and technical journals of the country, should have caught the September issue of The Automotive Manufacturer, which was the initial combination number of The Hub and Automotive Engineering. On any other issue the delay would have been self-explanatory to anyone reading the daily newspapers, but in this particular instance neither subscribers nor advertisers were aware of the consolidation of the two publications.

The strike, it should be explained, started on October 1, when the pressmen and feeders in all New York printing plants except the daily newspapers walked out because their demands for shorter hours, increased wages and extra overtime compensation, totaling about 68 per cent, and which they refused to arbitrate, were not granted. The action of the local unions was repudiated by the National organizations which backed the employing printers. The situation was subsequently complicated by the compositors going out in sympathy with the pressmen, not as a body but through the medium of "vacations." The strike is still in force at this writing, November 6.

On the last day of September our printer reported the forms on the presses and partly finished, with the expectation that they would be completed before the threatening strike broke. This hopeful promise was not fulfilled and the issue was not mailed until November 6. Through the fortunate circumstance of having our own composing room, as well as because of our foresight in subsequently making out-of-town arrangements for presswork, we now expect to mail this (October) issue before November 15, the November issue around December 1, and subsequent issues promptly on time.

In this matter we are fighting the advertiser's battle as well as our own, for the publishers have refused flatly the strikers' suggestion that the increase be passed along to the advertisers.

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Details of 300-Horsepower Maybach Airplane Engine--IV

(Continued from page 25, September Automotive Manufacturer)

GENERAL DATA

Make of engine and rated h.p.	Maybach 300 h.p.
Type number	1261.
Number and arrangement of cylinders	Six vertical.
Bore	165.0 mm.=6.50 in.
Stroke	180.0 mm.=7.09 in.
Stroke/bore ratio	1.09 : 1.
Area of one piston	213.825 sq. cm.=33.2 sq. in.
Total piston area of engine	1282.95 sq. cm.=199.2 sq. in.
Swept volume of one cylinder	3848.85 cu. cm.=235.3 cu. in.
Total swept volume of engine	23093.1 cu. cm.=1412.0 cu. in.
Clearance volume of one cylinder	778.9 cu. cm.=47.54 cu. in.
Compression ratio	5.95 : 1.
Normal b.h.p. and speed	294.0 b.h.p. at 1400 r.p.m.
Maximum b.h.p. and speed	304.5 b.h.p. at 1500 r.p.m.
Normal b.m.e.p.	117.7 lbs. per sq. in. at 1400 r.p.m
Maximum b.m.e.p.	120.5 lbs. per sq. in. at 1200 r.p.m
Piston speed	1654.0 ft. per min. at 1400 r.p.m.
Mechanical efficiency (calculated)	86.0 per cent.
Indicated mean pressure (calculated)	137.0 lbs. sq. in.
Fuel consumption per b.h.p. hour	0.526 pint=0.473 lbs.
Brake thermal efficiency	28.9 per cent.
Indicated thermal efficiency	33.6 per cent.
Air standard efficiency	51.0 per cent.
Relative efficiency	65.9 per cent.
Cu. in. of swept volume ber b.h.p.	4.80 cu. in.
Sq. in. of piston area per b.h.p.	0.678 sq. in.
H.p. per cu. ft. of swept volume	360.0 b.h.p.
H.p. per sq. ft. of piston area	212.4 b.h.p.
Direction of rotation of crankshaft	Anticlockwise (facing propeller)
Direction of rotation of propeller	Anticlockwise (facing propeller)
Type of valve gear	Overhead valve rockers and push rods.
Type of starting gear	Maybach of special design.
Number of carbureters	Two Maybach.
Bore of main jets	Variable from 0.0 to 2.5 mm.
Bore of pilot jets	Variable from 0.0 to 1.1 mm.
Fuel consumption per hour	19.33 galoins.

Valve Areas and Gas Velocities

Diameters.	
Induction pipe	62.0 mm.=2.44 in.
Inlet port	45×67 mm.=1.77×2.64 in.
Exhaust port	45×67 mm.=1.77×2.64 in.
Exhaust branch pipes	66.0 mm.=2.60 in. (approx.)
Cross Sectional Areas.	
Induction pipe	29.26 sq. cm.=4.67 sq. in.
Inlet port	30.15 sq. cm.=4.67 sq. in.
Inlet valve (π dh.)	4.416 sq. in. (total).
Exhaust valve (π dh.)	4.366 sq. in. (total).
Exhaust port	30.15 sq. cm.=4.67 sq. in.
Exhaust branch pipes	34.11 sq. cm.=5.31 sq. in.
Gas Velocities.	
Induction pipe	196.1 ft. per sec.
Inlet port	196.1 ft. per sec.
Inlet valve	208.0 ft. per sec.
Exhaust valve	210.0 ft. per sec.
Exhaust port	196.1 ft. per sec.
Exhaust branch pipes	172.5 ft. per sec.

INLET VALVES (Two per cylinder).

Outside diameter	54.0 mm.=2.126 in.
Port diameter (in cylinder head)	48.0 mm.=1.89 in.
Width of seating	3.5 mm.=0.137 in.
Angle of seating	30 deg.
Radius under valve head	20.0 mm.=0.787 in.
Lift of valve	9.45 mm.=0.372 in.
Diameter of stem	11.0 mm.=0.433 in.
Over-all length of valve	136.5 mm.=5.373 in.
Number of springs per valve	One.
Free length of spring	52.5 mm.=2.066 in.
Length of spring in position (no lift)	39.5 mm.=1.55 in.
Mean diameter of coils	51.0 mm.=2.00 in.
Gauge of wire	No. 6 b.w.g.
Ratio length of spring/lift of valve	4.17 : 1.
Weight of valve complete with spring	0.843 lb.
Weight of spring bare	0.281 lb.
Inlet valve opens, deg. on crank	8 deg. early.
Inlet valves closes, deg. on crank	35 deg. late.
Period of induction	223 deg.
Inlet tappet clearance	0.3 mm.=0.012 in.

EXHAUST VALVES (Two per cylinder).

Outside diameter	54.0 mm.=2.126 in.
Port diameter (in cylinder head)	48.0 mm.=1.89 in.
Width of seating	3.5 mm.=0.137 in.
Angle of seating	30 deg.
Radius under valve head	9.0 mm.=0.354 in.
Lift of valve	9.34 mm.=0.368 in.
Diameter of stem	11.0 mm.=0.433 in.
Length of valve guide	80.0 mm.=3.149 in.
Over-all length of valve	152.5 mm.=6.00 in.
Number of springs per valve	One.
Free length of spring	52.5 mm.=2.06 in.
Length of spring in position (no lift)	39.5 mm.=1.55 in.
Mean diameter of coils	51 0 mm.=2.00 in.
Gauge of wire.	No. 6 b.w.g.
Ratio. Length of spring/lift of valve	4.21 : 1.
Weight of valve complete with spring	0.881 lb.
Weight of spring bare	0.281 lb.
Exhaust valve opens, deg. on crank	33 deg. early.
Exhaust valve closes, deg. on crank	7 deg. late.
Period of exhaust	220 deg.
Exhaust tappet clearance	0.4 mm.

Inertia Forces, Bearing Loads, etc.

Weight of piston, complete with rings and gudgeon pin	14.05 lbs.
Weight per sq. in. of piston area	0.4235 lb.
Wt. of connecting rod complete	8.93 lbs.
Weight reciprocating part of connecting rod	3.305 lbs.
Total reciprocating weight per cylinder	17.355 lbs.
Weight per sq. in. piston area	0.538 lb.
Length of connecting rod (centers)	310.0 mm.=12.20 in.
Ratio. Connecting rod/crank throw	3.445 : 1.
Inertia, lbs. sq. in. piston area, top center	137.0 lbs. sq. in.
Inertia, lbs. sq. in. piston area, bottom center	75.5 lbs. sq. in.
Inertia, lbs. sq. in. piston area, mean	53.25 lbs. sq. in.
Weight of rotating mass of connecting rod	5.625 lbs.
Total centrifugal pressure	1,106 lbs.
Centrifugal pressure, lbs. sq. in. piston area	34.4 lbs sq. in.
Mean average fluid pressure, including compression	48.0 lbs. sq. in.
Mean average loading on crank-pin bearing, total from all sources in terms of lbs. sq. in. piston area	118.0 lbs. sq. in.
Diameter of crank-pin	66.0 mm.=2.598 in.
Rubbing velocity	15.85 ft. sec.
Effective projected area of big end bearing	43.23 sq. cm.=6.70 sq. in.
Ratio. Piston area/projected area of big end bearing	4.96 : 1.
Mean average loading on big end bearing	585 lbs. sq. in.
Load factor on big end bearing	9,270 lbs. ft. sec.

Cylinders.

Over-all height of bare cylinder from top of base chamber	479.5 mm.=18.87 in.
Depth of spigot at base of cylinder	3.5 mm.=0.13 in.
Diameter of cylinder over water jacket	185.0 mm.=7.28 in.
Valve centers (between inlet and exhaust)	63.0 mm.=2.48 in.
Thickness of flange at base of cylinders	12.0 mm.=0.47 in.
Number of holding-down studs per cylinder	Four.
Diameter of holding-down studs	19.0 mm.=0.74 in.
Thickness of water jacket	1.0 mm.=0.039 in.
Mean thickness of combustion chamber wall	8.0 mm.=0.31 in.
Mean thickness of cylinder barrel	3.0 mm.=0.11 in.
Tensile stress	6,640 lbs. sq. in. (approx.) Assumed maximum pressure 450 lbs. sq. in.)

Piston.

Type of piston	Cast iron (flat crown).
Diameter at top	164.25 mm.=6.466 in.
Diameter at bottom	164.75 mm.=6.486 in.
Length	151.00 mm.=5.944 in.
Ratio. Piston length/cylinder bore	0.914 : 1.
Number of rings per piston	Three piston rings, one scraper ring.
Position of rings	All above piston pin.
Width of rings	6.5 mm.=0.255 in.
Gaps of rings in cylinder	1.39 mm.=0.055 in.

Connecting Rod.

Length between centers	310.0 mm.=12.205 in.
Ratio. Connecting rod/crank throw	3.44 : 1.
Little end bearing type	Floating cast iron bush.
Floating bush, diameter, inside	38.0 mm.=1.496 in.
Floating bush, diameter, outside	44.3 mm.=1.743 in.

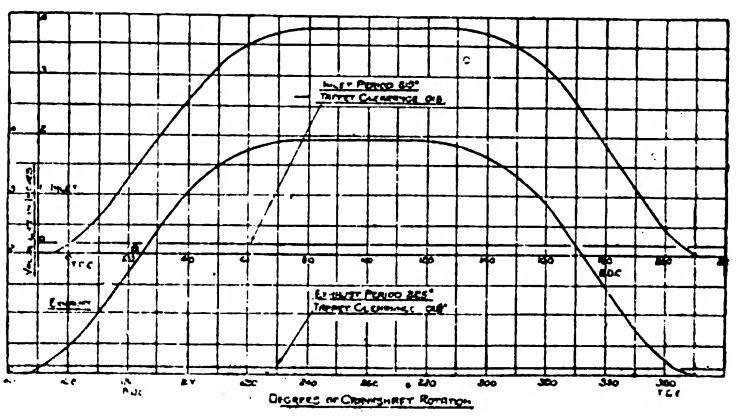

Fig. 31—Diagram of valve lift, from R. A. E. tests. (See also cam profile and valve opening diagram, Fig. 15, May issue Automotive Engineering, page 228.

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Floating bush, effective length inside ..... 93.0 mm.=3.661 in.
Floating bush, projected area of bearing on gudgeon pin..... 35.35 sq. cm.=5.48 sq. in.
Ratio. Piston area/projected area of little end bearing..... 6.06 : 1.
Big end bearing. Type..... Bronze shell lined white metal.
Big end bearing. Diameter..... 66.0 mm.=2.598 in.
Big end bearing. Length (actual). 73.56 mm.=2.893 in.
Big end bearing. Length (effective) ..... 65.5 mm.=2.580 in.
Big end bearing. Projected area.. 43.23 sq. cm.=6.700 sq. in.
Ratio. Piston area/projected area of big end bearing..... 4.96 : 1.
Number of big end bolts..... Four.
Full diameter of bolts..... 14.0 mm.=0.551 in.
Diameter at bottom of threads.... 12.0 mm.=0.472 in.
Total cross sectional area, bottom of threads ..... 4.520 sq. cm.=0.70 sq. in.
Pitch of threads..... 1.5 mm.
Total load on bolts at 1,400 r.p.m.. 5,824 lbs.
Total load on bolts at 1,600 r.p.m.. 7,602 lbs.
Stress per sq. in. at 1,400 r.p.m.... 8,320 lbs. sq. in.
Stress per sq. in at 1,600 r.p.m.... 10,860 lbs. sq. in.

Crankshaft.

Number and type of main bearings. Seven bronze shell lined white metal.
Cylinder centers ..... 187.0 mm.=7.362 in.
Crank-pins.
Outside diameter ..... 66.0 mm.=2.598 in.
Inside diameter ..... 38.0 mm.=1.496 in.
Length ..... 74.0 mm.=2.913 in.
Journals.
Outside diameter ..... 66.0 mm.=2.598 in.
Inside diameter ..... 36.0 mm.=1.417 in.
Length, propeller end..... 67.0 mm.=2.638 in.
Length, rear end..... 67.0 mm.=2.638 in.
Length, center ..... 67.0 mm.=2.638 in.
Length, intermediate ..... 67.0 mm.=2.638 in.
Crank Webs.
Width ..... 95.0 mm.=3.740 in.
Thickness ..... 23.0 mm.=0.906 in.
Radius at ends of journals and crank-pins ..... 4.5 mm.=0.171 in.
Weight of complete shaft..... 99.9 lbs.

Working Clearances.

Piston clearance, top (total)..... 0.75 mm.=0.029 in.
Piston clearance, bottom (total).. 0.25 mm.=0.009 in.
Side clearance of connecting rod in piston (total)..... 11.8 mm.=0.464 in.
Side clearance of big end on crank-pin (total) ..... 0.44 mm.=0.0173 in.
End clearance of crankshaft in main bearings ..... 3.0 mm.=0.118 in.
Clearance of valve stem in guide (inlet) ..... 0.12 mm.=0.00472 in.
Clearance of valve stem in guide (exhaust) ..... 0.15 mm.=0.0059 in.

Lubrication System.

Number and type of oil pumps.... Three, rotary gear.
Oil consumption per hour..... 11.0 pints.
Oil consumption per b.h.p. hour... 0.037 pints.
Oil temperature ..... 65 deg. C.
Oil pressure ..... 5.0 lbs. per sq. in.
Specific gravity of oil..... 0.899 s.p.g.
Ratio. Pump speed/crankshaft speed ..... 1 : 2.
Pump delivery (calculated at 100 per cent volumetric efficiency).. 91 gallons per hour at normal engine revs.

Ignition.

Number and type of magnetos.... Two Bosch.
Firing sequence of engine..... 1-5-3-6-2-4.
Ignition timing (fully advanced).. 38 deg. early.
Number of plugs per cylinder..... Two.
Type of plugs..... Bosch 3 point.
Ratio. Magneto speed/engine speed ..... 1.5 : 1.

Cooling System.

Number and type of water pumps. One centrifugal.
Diameter of inlet pipe..... 54.0 mm.=2.126 in.
Diameter of outlet pipe..... 50.0 mm.=1.966 in.
Diameter of rotor..... 111.0 mm.=4.36 in.
Water capacity of one cylinder.... 1284.0 cu. cm.
Number and type of radiators.... One, semicircular honeycomb.
Ratio. Water pump speed/engine speed ..... 2 : 1.
Water temperature, inlet..... 57 deg. C.
Water temperature, outlet..... 68 deg. C.

Fuel Pump.

Number and type of fuel pumps... One Maybach, double acting.
Bore ..... 15.0 mm.=0.59 in.
Stroke ..... 17 mm.=0.66 in.
Normal delivery ..... 264 pints per hour at 800 r.p.m.
Maximum delivery ..... 630 pints per hour at 1,275 r.p.m.
Ratio. Pump speed/crankshaft speed ..... 1 : 2.

Weights.

Weight of complete engine, dry, with propeller boss and exhaust manifold ..... 911 lbs.
Weight per b.h.p., ditto..... 3.10 lbs.
Weight of fuel per hour..... 139 lbs.
Weight of oil per hour (s.p.g. 0.899) ..... 12.36 lbs.
Total weight of fuel and oil per hour ..... 151.36 lbs.
Gross weight of engine in running order, less fuel and oil (cooling system at 0.65 lbs. per b.h.p.).. 1102.0 lbs.
Weight per b.h.p., ditto..... 3.79 lbs.
Gross weight of engine in running order, with fuel and oil for six hours (tankage at 10 per cent weight of fuel and oil)..... 2100.9 lbs.
Weight per b.h.p., ditto..... 7.14 lbs.

GENERAL ANALYSIS OF WEIGHTS

Description of Part	No. per set	Average unit in lbs.	Weight of complete set in lbs.	Percentage of total weight
Cylinders, bare	6	32.75	196.50	21.59
Pistons, complete with rings and piston pin set screws.	6	12.30	73.80	8.11
Piston pins	6	1.75	10.50	1.15
Connecting rods and floating bushes	6	8.93	49.12	5.39
Crankshaft, complete with oil rings	1	99.90	99.90	10.98
Crankshaft extension, with nut and pin.....	1	4.00	4.00	0.44
Inlet valves	12	0.43	5.25	0.57
Exhaust valves	12	0.47	5.70	0.62
Inlet and exhaust valve springs	24	0.28	6.74	0.74
Inlet and exhaust valve collars, with cotters and locking devices	24	0.12	3.00	0.32
Thrust, complete with bull races, propeller hub flange, and camshaft driving sprocket	1	17.68	17.68	1.94
Camshafts	2	10.00	20.00	2.20
Overhead valve rockets, complete	12	1.08	12.99	1.42
Overhead rocker bearings, complete	24	0.42	10.50	1.15
Valve tappets and guides....	12	0.93	11.25	1.23
Crankcase, top half.....	1	94.30	94.30	10.36
Crankcase, bottom half.....	1	41.32	41.32	4.54
Bearing caps	6	2.68	16.12	1.77
Front bearing cap.....	1	5.56	5.56	0.61
Crankcase holding-down bolts, with clamps, nuts and washers	14	2.40	33.60	3.70
Induction pipe, complete....	1	9.09	9.09	1.00
Propeller hub, with bolts and nuts	1	21.00	21.00	2.30
Inlet valve push rods.....	6	0.48	2.90	0.32
Exhaust valve push rods....	6	0.49	2.97	0.33
Inlet and exhaust stiffening plates	2	2.00	4.00	0.44
Oil pumps, with drive and pipe	1	9.00	9.00	0.98
Rear cover plate.....	1	6.06	6.06	0.66
Front cover plate.....	1	4.00	4.00	0.44
Water pump, complete.....	1	8.50	8.50	0.93
Camshaft, oil and water pumps driving gears.....	1	13.65	13.65	1.50
Wireless clutch	1	5.06	5.06	0.55
Revolution counter gear.....	1	2.62	2.62	0.28
Machine gun interrupter gear	1	1.82	1.82	0.20
Fuel pump	1	3.50	3.50	0.38
Magnetos	2	10.75	21.50	2.36
Magneto wiring	1	4.75	4.75	0.52
Oil pipes	1	4.00	4.00	0.44
Self-starter gear	1	6.00	6.00	0.66
Exhaust manifold	1	27.00	27.00	2.96
Carbureters	2	16.00	32.00	3.51
Miscellaneous	..	....	3.75	0.41
Total weight of engine.....	..	....	911.00	100.00

METALLURGICAL ANALYSIS OF PRINCIPAL PARTS

	Carbon per cent.	Graphite Carbon per cent.	Combined Carbon per cent.	Silicon per cent.	Manganese per cent.	Sulphur per cent.	Phosphorus per cent.	Nickel per cent.	Chromium per cent.
Cylinder head ..	...	2.57	0.91	1.60	0.70	0.131	0.34	...	...
Cylinder barrel ..	0.49	...	...	0.33	1.01	0.028	0.054	...	...
Cylinder water jacket	0.25	...	...	0.27	0.63	0.032	0.037	...	...
Piston	...	2.42	0.83	1.29	0.83	0.111	0.30	...	...
Piston pin floating bush	...	2.39	0.65	1.43	0.76	0.146	0.47	...	...
Piston pin	0.28	...	...	0.23	0.48	0.028	0.022	...	...
Connecting rod ..	0.15	...	...	0.33	0.31	0.027	0.010	1.42	0.49
Inlet valve	0.53	...	...	0.30	0.48	0.032	0.044	4.01	0.51
Exhaust valve ..	0.10	...	...	0.20	0.26	0.019	0 023	3.62	1.16
Crankshaft	0.31	...	...	0.31	0.63	0.030	0.015	4.01	0.83
Camshaft	0.10	...	...	0.25	0.23	0.022	0.040	3.46	0.68
Camcore	0.17	...	...	0.23	0.75	0.036	0.014	0.47	...

	Lead per cent.	Iron per cent.	Tin per cent.	Copper per cent.	Zinc per cent.	Antimony per cent.	Silicon per cent.	Manganese per cent.
Big-end bearing metal	3.51	...	80.05	6.34	....	9.90	...	....
Main journal bearing	0.92	...	77.65	10.00	....	11.18	...	....
Crankcase	...	0.99	....	0.87	12.01	Aluminum (by Diff) 86.57	0.56	trace

MECHANICAL TESTS

Mechanical tests were made on the crankcase and crankshaft, the results of which are given below:

CRANKCASE

Mark	Diam.	Max. Stress	Elongation, per cent
T	0.253	11.65	1
L	0.254	11.28	1

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CRANKSHAFT

Position	Diam.	Mark	Yield Stress	Max. Stress tons/sq. in.	P.C. Elong. on 4A	R. of A. per cent.	Impact ft. lbs.
End	1	0.254	59.0	63.1	14.3	56.3	17.21
Journal	2	0.254	...	...	...	...	...
Web	3	0.254	61.6	64.1	15.1	54.6	16.121
Long.	4	....	...	...	...	...	...
Crank-pin, long..	5	0.254	63.6	67.1	15.1	55.7	12.12
	6	...	...	...	...	...	...
Web trans.	7	0.254	61.4	65.3	7.2	10.5	5.5

Britain Building Big 'Plane Engine

What is said to be the largest airplane engine in the world has recently been put under the first test at the "Sunbeam" works at Wolverhampton, England. It is reported to be of 1,000 nominal horsepower, developing about 900 horsepower at normal working speeds. It was not run at full power on the first trial, and was dismantled for examination, after which it will be reerected for a full power test. The engine has 12 cylinders arranged V fashion, and weighs less than two pounds per h.p. Special airplanes are to built to suit the engine, while it is also probable that it will be fitted to some of the later giant airships. It is stated that the biggest airplane engine previously made was an Italian production (Fiat A14, 700 h.p.)—Consular Report.

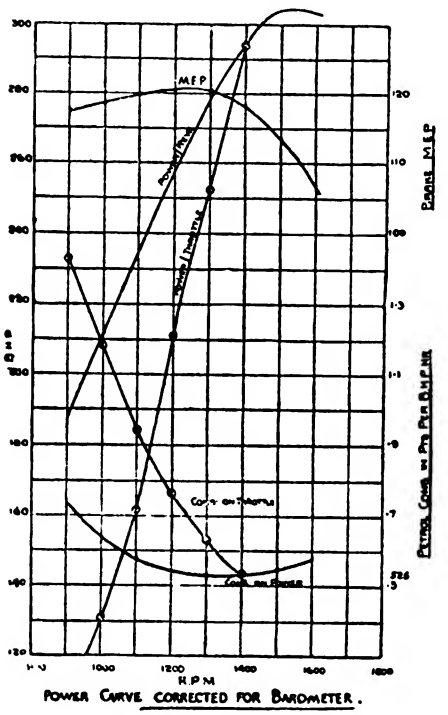

Fig. 32—Calibration curves of Maybach biplane engine showing power, from R. A. E. tests

Truck and Airplane Firms to Merge

Plans have been worked out for a merger of the Wright-Martin Aircraft Corp., now practically idle after doing a tremendous business in planes and Hispano-Suiza motors, with the International Motor Truck Corp., which is doing a splendid business in heavy motor trucks with a 1919 rate of earnings which promise about $3,500,000 before deductions for taxes and preferred dividends.

Holders of Wright-Martin preferred stock, under the plan, will receive $120 par value of International Motor first preferred for each of their present shares and accumulated dividends. Holders of Wright-Martin common shares will receive for each 100 shares 2.8 shares of second preferred ($100 par) and two shares of common stock (no par) of International Motors, along with 25 shares of no par value stock of the new company which will conduct the aircraft business and retain the Simplex automobile patents.

International Motor will increase its capital to take care of the transaction. There will, however, be no change in its common shares. Both first and second preferred shareholders of International will retain their present holdings under the plan and receive in addition the amount of their accumulated dividends in the same class of stock, at par, as now held.

Swiss Expert Produces Conducting Aluminum

A new invention called conducting aluminum M. 277, which is said to be creating a profound impression, has been made by Dr. Georges Giulini, the most famous expert in the aluminum trade. This new metal is produced by putting the ordinary aluminum through a special patented process by which it acquires the same mechanical qualities and capacities as bronze, copper, and brass without changing its specific weight.

It is said that the price of the new metal can be kept within very low limits, so that, even at the prewar prices of other metals it will be able by reason of its smaller specific weight, to compete with copper and brass very favorably. The fact that the new metal is a conductor will make it especially in demand in the electrical trade. The inventor anticipates for it also a good market among the builders of motor cars, aeroplanes, ships, and railway carriages. Leading men, to whom the invention is already known, are said to be much impressed with its possibilities.—Consul Philip Holland, Basel, Switzerland.

New Oil Field Found in Durango, Mexico

According to Vice-Consul Cunningham, located at Mexico City, the operations of prospectors in the neighborhood of Mapimi, in the state of Durango, have led conclusively to the belief in government circles that there exist large and important oil deposits in that vicinity. Already on the basis of these explorations several claims have been filed in the Department of Petroleum of the Secretariat of Industry, Commerce and Labor, and the concessions have been granted. The action of the government in conceding titles is in accordance with the prevailing laws which allow the conferring of titles to lands in vicinities which have not yet been opened up for exploitation. Further concessions for new wells will not be granted in regions where petroleum is now produced, pending the enactment of the proposed petroleum laws which are now being considered by the National Congress. This new oil region is adjacent to the important mining section of Velardena and Pedricena, within easy reach of Parral and Torreon, and there is good railway connection with Monterrey and the industrial region thereabouts.

It is understood that the concessionaries above mentioned have already taken the first steps toward obtaining necessary drilling machinery, and it is expected that within three months active operations will be in progress.

Motorcycles in China Use Footpaths

Motorcycles are attracting considerable interest in China, primarily, it is said, because they can travel on the paths used by pedestrians, as there are few roads in the country suitable for motor cars. If these paths were improved, commercial travelers, by the use of motorcycles, could penetrate the country more easily, reaching places which are now considered inaccessible

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New and Improved Ideas in Body Finishing

Varnish Color—An Indispensable Product

Years ago prejudice was largely responsible for the disfavor bestowed upon varnish-color. It was charged with being responsible for the cracking of the finish, for premature loss of lustre, and so on. All this exaggeration has been swept away, and for the past 15 years, at any rate, varnish-color has become an enormously used product just as the quality of the finish during this period has steadily improved.

Varnish-colors and glazing pigments, the latter being made of so-called transparent pigments and rubbing varnish, while the former is the result of mixing opaque and semi-opaque colors in varnish, represent two forms of varnish-color.

One of the main reasons supporting the use of varnish-color is that it provides for the quick and substantial building up of the finish while maintaining the original purity of the color. Additionally, greater brilliancy is obtained for the finish and finer color effects established.

As a rule, the shop mixing of varnish-colors is not to be encouraged, except in emergency cases. Quite often the painter in shops mixing his varnish-color is inclined to think that it can just as well be made of odds and ends, and the result is when this plan is practiced that a vicious and unsuitable material is developed.

Varnish-color should be made of uniformly good materials. In mixing proceed as follows: Pour the desired quantity of rubbing varnish into the container. Then add the color gradually, meanwhile shaking the container well in order to obtain the proper mixture. Use ½ lb. of color to 4 lbs. of varnish. Make the varnish-color a day or two in advance of requirements.

Before adding the color to the varnish reduce it with turpentine to a heavy cream-like consistency.

In the event of buying the supply of varnish-color—and, all things considered, this is about the most economical plan—procure it of a reputable manufacturer. If only a small quantity of the material is used it had best be obtained in pint and quart cans, so that a comparatively fresh, good-working and drying material is at all times available.

Stock-keeping for the Paint Shop

Even the comparatively small paint shop should maintain some good, efficient plan of handling and taking care of paint and varnish supplies. In the case of the shop employing several men some one man especially interested in the mixing, matching and care-taking of the paints and varnishes, tools, etc., should be delegated to take charge of the stock and be responsible for all material in connection therewith. More uniform stock and supplies will be the result, and greater efficiency will develop from such a system of personal oversight. A clean, well-lighted corner of the shop should be set apart for the stock, and brush, and general tool storing department. Enclosed shelf space, in plenty, should be provided, on which, for a medium-sized shop, the oils, thinners, japans, colors and even the varnishes may be kept. These oils, thinners, japans and other mediums had best be handled in one-half gallon cans, the waste being less from small containers than large ones.

Where a careful, conscientious man is in charge of the paint shop stock the waste will be very much less, both in mixing and in working up stock. There will be odds and ends of pigments, liquid and thinning mediums, etc., which under careful management can be worked up and made into excellent mixtures for miscellaneous purposes. No surplus of unavailable colors or pigments should be allowed to accumulate, and under the control of a good stock keeper no surplus will accumulate.

Preferably the stock keeper should be a first class colorist and color matcher and mixer. Many colors are daily coming along which are bad to match, and this work turned over to an untrained or unexperienced man, or to one lacking color "instinct," is practically certain to prove a burden to the proprietor of the business.

Cleanliness is a supreme consideration in the care taking of the paint shop stock department. This one feature discloses the sort of mechanic in charge of stock.

The paint bench and its belongings are said to be an accurate index to the qualifications and habits of the man in charge. Every tool, every bit of pigment, or quantity of varnish, should have a place on the stock shelves and be kept there. It is unnecessary to enumerate the belongings of the stock department. Whether simple or elaborate, they need to be kept in first class, workable condition.

Relation of Pure Turpentine to Good Painting

It is not always easy to estimate this relation in dollars and cents, but it is a relation which exists, nevertheless. In the common, everyday grind of shop work matters of this kind are often lost sight of and are only brought sharply to our attention when the finish on some important job goes wrong and it becomes necessary to trace the cause of it.

With the increasing number of delicate, sensitive colors being used in fine carriage and automobile painting, pure turpentine of the very highest quality becomes indispensable. While turpentine is ordinarily considered only a thinner it, at the same time, in performing this function exerts such an effect on the pigments or mediums that they are to an important extent harmed or benefited thereby. Turpentine, however, deserves to be classed as something more than a mere thinner of paints and paint-mixing mediums, for in connection with this office it imparts to the materials in which it is used a binding and adhesive property of no small value. This is accomplished through a residue left behind upon the completion of the process of evaporation.

In buying turpentine it is well for The Hub readers to observe that a too recently distilled turpentine, absolutely pure so far as foreign substances are concerned, will act injuriously upon the tint or shade of many if not most colors, and especially of lighter toned pigments.

The adulterated turpentine is nevertheless the main material to guard against. The greatest danger from this source comes from indiscriminately buying of local dealers who, although for the most part honest, are easily imposed upon by unscrupulous venders of spurious supplies.

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Probably the most certain and inexpensive way of insuring your business against adulterated turpentine is to test each individual lot with a hydrometer of proved accuracy. With a first class instrument of this kind pure turpentine should test 31 degrees Baume. If turpentine under this test registers 31½ degrees or below 30½ degrees Baume it stands convicted of being an adulterated article. In buying in barrel lots the work of testing is materially reduced since it costs no more to test a lot of this size than one of lesser quantity. A 5 per cent addition of benzine or headlight oil will raise the registration of turpentine to 31½ degrees. Headlight oil discolors turpentine quickly, while benzine is neutral in this respect, but roughens the feel of it, and, more important still, imparts this roughness to the color when applied to the surface. Resin oil destroys both color and drying or evaporating quality.

Good Advice a Necessary Part of the Painting Business

It is not all painting to paint, if you are the owner of a painting business. A certain essential part of business is giving advice. While this may not be estimated as a business asset it will prove in the long run a business getter. The carriage, wagon, or car owner, as a rule, appreciates any advice calculated to be of benefit to him in getting the best possible service out of his investment in paint and varnish. It is very seldom that this advice, if tendered in the right spirit, is not to a greater or less extent taken advantage of. In return for this helpful attitude manifested by the painter the kindly word and the influence of the vehicle owner is generally effective in bringing new business to the shop. It is manifest, therefore, that anything the painter can do to help the vehicle owner prolong the wearing properties of the finish, and incidentally get more pleasure out of it while it wears, the more he will eventually profit by the information tendered.

One of the most important features of advice is that covering the washing of the car or carriage. First in the matter of washing is the wherefore and the how. The surface needs to be kept as free as possible from the accumulations of dust, dirt, mud and other foreign substances, which is the wherefore of washing. How to wash —a simple matter if you really understand it—may be explained in this way: Flood, so far as possible, the accumulations from the surface under a heavy flow of water applied at a gentle pressure. This flow may be made by the use of a large, fleece wool sponge or by a hose from which the nozzle has been removed, thus letting the pipe volume of water run over the surface. After freeing the mud and dirt accumulations and causing them under the flow of water to run off the surface, continue with a second sponge and a fresh supply of clean water to go over the surface until the varnish is perfectly clean and free from all dirt, etc.

Then with a clean, lint-free wash leather lightly go over the surface catching up the water, but never putting on enough pressure to wipe away the fine spray of moisture. This will evaporate at once and save the finish from having the life and lustre rubber out of it. All parts of the carriage or car should be washed and cleaned alike.

Give this advice to the car owner. Also advise to keep the vehicle away from horse stables, ammonia fumes, etc. Urge varnishing the vehicle twice a year as a matter of economy. Furnish other practical advice as circumstances warrant. Thereby profit your own business.

Surfacing Defects and Their Cure

At the rate which automobiles are being made, painted, finished, and turned into service, the wonder is that so few surface defects are to be noted. There are many of them, to be sure, but naturally we have reason to expect many more. Readers of The Hub who may be owners of or connected with comparatively small shops are no doubt now getting plenty of this hurriedly painted and finished work. The bad feature of steel sheet surfaces is that their fractures, chipped off spots, flaking, etc., are always rusty, and if they have been long exposed to the weather the corrosion is thick and firmly seated.

The only sure way of eradicating it is by first scraping it down to the bright metal, then sandpapering it smooth, fetching the edges of the break down with a scraper and sandpaper, and then smoothing the patch out clean and fine. Then apply some good metal primer bought ready to use or shop made. If the latter, use pure raw linseed oil and turpentine in the proportion of one part oil to three parts turpentine, adding lampblack or some good oxide paint. Red lead is another excellent pigment for first coating metal surfaces. The main thing in first coating up these steel surfaces is to get an elastic, hard sticking material in place. Putty directly upon this, using ordinary hard-drying putty and applying it to the surface so that it will extend above the old surface sufficiently to level down perfectly under the sandpaper or rubbing stone. As a rule, it is always economical to confine the putty directly to the defect. This saves time in leveling down. It also makes a better looking piece of work, for no matter how thorough the surfacing processes it is always difficult, and sometimes impossible, to clean off and remove all traces of surplus putty.

In case of having much putty to level down it is best to use a block of artificial pumice stone or rubbing brick dipped in equal parts of turpentine and raw linseed oil. This prevents any moisture from getting into the fractured or scaled parts. With these putty spots brought down level with the surrounding surface, the surface is now ready to be coated in with color. Then apply a coat of varnish color, or two coats if necessary, to bring out the finish right and maintain the purity of the color. Upon this surface stripe and ornament, and then apply one coat of clear rubbing varnish and one coat of finishing varnish.

Farmer Biggest Truck User

Going back to 1917 figures, the last year for which complete statistics were available, an analysis of the motor trucks in use shows that the American farmer is the biggest user of motor trucks in the world. In that year, farmers owned and operated 79,789 trucks as compared with manufacturers with 75,928 and retail merchants with 74,486. Estimates for 1918 show that the farmer is holding and perhaps increasing this lead. It is estimated that in the last year approximately 350,000,000 tons of farm products was hauled to market in motor trucks by the farmers and market gardeners. According to the average of actual cost figures, the cost of handling this tremendous total was approximately one-half that of horse-drawn transportation.

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Helpful Hints for Designers and Draftsmen

What Rights Does a Patent Give?

Every designer is greatly interested in the subject of patents, because practically every new design constitutes in part an invention, and it is only a question whether this has sufficient value to warrant the expenditure of time, trouble and money connected with taking out a patent. The question is often raised in this connection, what rights has an inventor under his patent? To answer this in a few words, says Chesla C. Sherlock in Machinery, he has the three primary rights, that is he can prohibit others from (1) making, (2) using or (3) selling his invention during the life of his patent. In addition he has the secondary rights of (4) injunction against further infringements, (5) to recover profits on all articles already made, and (6) to restrict making, using and selling in any desired manner.

These secondary rights are almost as valuable as the principal ones. Particular attention is directed to the right to restrict the making, using and selling of the article in any manner desired. This is a matter seldom understood by the patentee. No better example of the true rights of the patentee can be cited than the example of a safety razor. This razor is sold to retail dealers at about $3 with the agreement that it must be resold to the consumer at $5. Any cut in price will amount to an infringement of the patent and render the dealer liable upon that basis. Futhermore, the retailer signs a contract whereby he virtually acknowledges the validity of the patents under which the razor is made, so that he can never attack the company on that score. In the case of the blades, a similar agreement exists, but additional restrictions are placed upon the user of the blade to the extent that to resharpen the blade will be an infringement of the patent and render the purchaser of the blade liable as such. The courts have upheld this right on the part of the company making the razor, saying that the patentee has the right to restrict the making, using and selling of his patented article in any manner he desires.

It is a question of law how far the matter of resale prices can be carried. Thus far the courts have held that retailers can not be held as infringers if they cut the selling price, provided the article has not come to them directly from the patentee.

Another very important right exercised by the patentee is that of licensing his invention to others, thereby keeping a direct hold on the article and restricting its use to his own desires. The patentee unquestionably has the right to license others to use his invention, and he may restrict them in the use of the article in almost any conceivable manner. In speaking of this matter, one court said: "Within his domain the patentee is czar. The people must take the invention on the terms he dictates or else let it alone for 17 years. This is a necessity from the nature of the grant. Cries of restraint of trade and the impairment of the freedom of sales are unavailing, because for the promotion of the useful arts the constitution and the statutes authorize this very monopoly." This is a point seldom realized by patentees. A patent is a monopoly, and the most absolute monopoly that can be created in law.

A patent is personal property, and cannot be taken away from the patentee or his assigns except by due process of law, which in this case means constitutional decrees of the courts. A patent cannot be seized under a writ or other execution under the common law, although it may be attached by a creditor's bill in equity in default of payment of a judgment so obtained.

The patentee must give notice to the public that the article he is selling them has been patented. He must plainly stamp each article made with notice that it is patented. He may continue to so mark the articles even after the patent has expired, but to so mark an article which has not been patented is a criminal offense, punishable by a $100 fine, one-half of which goes to the person bringing the action.

Joint Ownership of Patents Different From Joint Invention

Where several parties own a patent an interesting situation arises. Any party may sell his rights or dispose of them in whatever manner he desires, absolutely independently from the others, even if the relative interest is unbalanced. Where a patentee so disposes of a portion of his patent by means of a license it is interesting to note that the licensee does not become an owner of a part of the patent, even in the most limited sense of ownership. A licensee has absolutely no rights of ownership and must not be considered to have, even though the license grants him the right to make, use and sell the article in a limited sense.

Where there are joint inventors the patent may be taken out in the name of both, but where it is taken out in the name of two parties when one of them is in fact the sole inventor, the patent is invalid. This often arises in cases where an employe invents a new machine and the employer furnishes the money. Both feel that their own interests must be protected, so they take out the patent in their joint names. Unless the employer is an actual co-inventor, the patent as issued is invalid. It is possible for only the inventor to receive the patent in his name, but he may in turn assign all or part of it as he desires, and the employer's interest will be fully protected by entering into a contract with the employe whereby the latter is to assign a certain portion of the patent or all of it, as the case may be, to the employer as soon as it is issued from the patent office. This statement concerning joint inventors must not be confused with joint ownership. There may be joint ownership in a patent, but that is radically different from joint invention.

The purpose of the government is to grant the patent, and the monopolistic rights going with it, to the actual inventor. One man may merely have the idea of the invention and go to another and have him make the necessary machinery to carry it out, but the first party acquires the patent rights because he is deemed the real inventor. If the man hired to put the plan into execution adds minor improvements of his own they become the property of the first party unless they amount to new inventions in themselves. Thus the government protects those of limited mechanical skill in their conceptions.

Distribution of Metal in a Tractor

It is interesting to note just how the materials entering into a tractor are distributed, and one tractor manufac-

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turer has furnished an analysis of his machine which gives this information. His machine has a total weight of 4,944 lbs., the metal in which is distributed as follows:

	Pounds	Per cent
Gray iron	1,561	31.6
Rear hubs	140	2.8
Front hubs	56	1.1
Lugs	342	6.9
Channels	378	7.6
Tees	94	1.9
Plates	429	8.6
Cold rolled	270	5.4
Sheet steel	30	0.6
Steel castings	602	12.1
Malleable castings	102	2.0
Brass castings	49	1.0

On the basis of the 1919 estimates which have been given out, the total of tractors for the year will reach 300,000. If this be discounted to the extent of putting the total at only 200,000, the above table shows that the tractor industry will require about 500,000 tons of iron and steel, approximately 10,000,000 lbs. of brass, and more than 6,000,000 lbs. of sheet steel. Alloy steels are being used in larger quantities on each new machine designed, and on each only one redesigned; in striving for maximum strength with minimum weight, manufacturers must come to it. One manufacturer reports the use of 40 in. of 1 in. round chrome-nickel steel. If but half the tractors had this much it would make up the tidy little total of a million pounds.

Some Unknown American Engineering War Work

It is not generally known that engineers connected with the American naval forces left a permanent monument in Scotland at Rosyth in the form of a reservoir for oil. Besides the reservoir, they built a pipe line from the Clyde to the Forth.

The reservoir is remarkable for its size and for the fact that it is built of reinforced concrete, although it is founded on rock. Its size may be gathered from the fact that its roof area is 7½ acres or 35,493 sq. yards; the area covered by the reservoir and its associated works being 11¼ acres. Its walls are 35 ft. high; the amount of rock excavated was 300,000 cubic yards, and the amount of concrete deposited 98,500 cubic yards. The holding capacity is 60,000,000 gallons oil. To ensure tightness a number of novel devices have been introduced, though when first tested these did not prove adequate, as the floor leaked considerably, and a complete new floor was laid. The reservoir is easily the largest oil reservoir in Britain, and probably in the world.

Handy Method of Repairing Slide Rule

So many draftsmen and engineers use the slide rule practically all the time that no excuse is necessary for a tip in connection with these. Warren Ichler, writing one of the mechanical papers, says that when repairs are needed on slide rules, a great deal of time is often lost through long hand methods of making calculations until the rule has been sent to the nearest engineering supply house for repairs. This is especially true when engineers are engaged in field work or stationed in the smaller towns and cities. The writer has occasionally repaired slide rules when the runner glass has been broken, by substituting a piece of celluloid cut from a triangle. The most transparent celluloid should, of course, be used when obtainable, but in case of real necessity almost any available triangle may be used. The scribing of the hair line may be done with a safety razor blade, although other suitable means will doubtless suggest themselves. The runners which have been repaired in this manner have generally proved satisfactory in an emergency and have saved much time.

Superiority of Electric Steels

Higher in tensile strength to the extent of 15 per cent or more and greatly reduced cost mark electric steel produced in the electric furnace by comparison with open hearth and converter products. Electric furnace steel, when made to the same chemical specification, is always better than other steel. Usually such steel will run 15 per cent or better in tensile strength or in ductility, depending upon its heat treatment. It is easier to control the composition, and consequently electric steel can be made to more accurate specifications than other steel.

The following comparative physical properties of electric furnace versus open hearth steel made to the American Electric Railway "Axle Steel Specifications" is shown by the tests of a prominent metallurgical engineering firm for a large city street railroad line. These steels, after forging, were held one hour at a temperature of 1,450 to 1,460 deg. F. (785-793 deg. C.), then quenched in 65 deg. oil, then drawn back at 1,185 deg. F. (640 deg. C.) and cooled slowly in the furnace.

	A. E. R. A. Standard Specifications	Open-Hearth	Electric Steel
Elastic limit (lbs. per sq. in.)	55,000	41,060	64,850
Yield point (lbs. per sq. in.)	.....	41,060	64,850
Tensile strength (lbs. per sq. in.)	90,000	89,100	105,140
Elongation in 2 in. (per cent)	22	21.5	22.0
Reduction in area (per cent)	45	31.74	52.37
Character of fracture	.....	.....	silky cup
Elastic torsion	.....	16,750	33,700
Shearing strength	.....	62,400	76,000

The following is the estimate of operating cost per ton of liquid steel, produced by Pittsburgh three-ton type electric foundry furnace, in continuous operation, melting heavy steel turnings and superheating the steel to a fluidity suitable for small steel castings:

Melting Stock.	
1 ton heavy steel turnings—axle turnings	$12.00
1/20 ton (5 per cent) loss in melting axle turnings	0.60
Electric power, 550 k.w.h., at 1c	5.50
Electrodes, carbon, 20 lbs., at 9c (ante bellum price 4½c)	1.80
33 lbs. of mill scale (used as a decarbonizer)	0.09
Additions.	
8 lbs. 70 per cent ferromanganese, at 10c	0.80
5 lbs. ferrosilicon, at 5c	0.50
(Note that spiegel and 20 per cent ferrosilicon may be substituted at lower cost.)	
½ lb. aluminum	0.17
Labor and Maintenance.	
Wear and tear on refractory roofs and linings, at 40c per ton (some of our users average 20c per ton)	0.40
Furnace labor	1.00
Total cost of liquid steel in the ladle (per ton)	$22.86

Spray Cleaning a Labor Saver

What may prove a valuable hint to car manufacturers, garages and others having many dirty parts, units or vehicles to clean is the method adopted by the railroads during the war because of the shortage of labor. The old method of wiping over the locomotive with oiled waste was undoubtedly a tedious process, and really left many holes and interstices practically uncleaned. The American railroads are now using a spray of oil and water, which is directed on the parts to be cleaned by a jet of air. The proportions are about one gallon of oil to 300 gallons of water; the pressure used about 90 lbs. to the square inch; while the spray is directed on to the surfaces to be cleaned at an angle of about 45 deg. from a distance of about 18 in. The process is said to be much more economical alike in regard to time, waste, and oil than the old method, while it has the further advantage of reaching parts which the oily waste passes over—it is thorough.

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Wrong Methods of Doing Woodwork on Automobiles

Up to quite recently, had any one asked me where to look for the highest development along the line of efficiency I would have said, in the automobile plant. The magnitude of the industry and the large number of efficiency experts engaged to promote efficiency (for almost every plant has its efficiency staff) would naturally lead one to believe that little remained to be desired along this line. But I have had occasion to look into the matter a little, with the result that my opinion has been greatly modified.

It is true there are branches of the industry which are highly efficient, but I have found shops where some branches are decidedly otherwise—notably the wood-working and finishing branches. And this condition is to be found in some of the largest plants in the country. The condition can hardly be charged to a lack of efficient help because so far as I was able to observe, the trouble was due to wrong methods of doing the work (for which the heads of departments are responsible) rather than to inefficiency on the part of the workmen.

Shop efficiency does not mean training men to do good work in the hardest way; to my way of thinking it means doing the best work by the easiest and quickest possible method. Some handsomely finished cars are turned out of these plants, but the cost—well, only automobiles could stand it.

The finish on the higher-priced sedan and limousine is equal to the finish on a high grade piano, but the cost is many times as great, and all because the woodwork has not been properly cleaned up. No one expects a carpenter shop to turn out as fine work as a cabinet shop; and the work done in some of the automobile plants is not even good carpenter work, when it ought to be high grade cabinet work. And the finishing department seems to have become so accustomed to this poor woodwork that it accepts it as a matter of course and does the best it can with it.

I have seen shaped work go direct from the machine to the finishing department, and the latter was expected to make a good finish. To prepare this rough wood for a smooth finish it would get a coat of lead primer and was then glazed with putty and sanded, then more putty if necessary and more sanding. One-half the amount of sanding in the wood-working department, that was given in the finishing department, would have put it in pretty fair shape and rendered unnecessary the glazing, which is a slow, tedious job on some kinds of work.

Another thing observed was the lack of care in cleaning off the surplus glue from glue joints. In one shop where this was done the wood was torn away and the holes thus made had to be filled with putty to make a smooth surface for finishing. This surplus glue should be scraped off before it becomes so hard that the wood will pull away with it.

In the finishing, or paint department, not a few shops show the same lack of efficiency. Automobile finishing seems to be a development of the old method of carriage finishing, as distinguished from piano and furniture finishing. If automobile and piano and furniture finishers could get together and exchange experiences and ideas, each could learn something from the other.

Filler, as used for filling the pores of wood in piano and furniture finishing, seems to be all too little known in some automobile shops—either unknown or feared, because it is not used. The method of filling is that of putty and the glazing tool—a method that is both inefficient and costly; inefficient because it does not make as permanent a job as wood filler would do. Wood filler applied in the liquid state enters the pores of the wood, works itself among the fibers and secures a permanent hold.

With putty it is different. In the paste form it is pressed into the pores, but it cannot penetrate as deep nor work itself among the fibers as the liquid filler will do. To insure a full pore one must leave a sufficient amount on the surface to allow for shrinking, and putty does not make a durable surface or foundation for a finish. It is costly because the process is slow, very slow, compared with the process of wood filling. Then after it is filled it has to be sandpapered, which takes up a great deal of time.

If the woodwork on automobiles were cleaned up as well as it is cleaned up in most furniture factories, a great saving in cost would result. Up to the present time most of the car has been made of metal and the finisher has given more thought to metal finishing than to wood finishing. The time is coming, however, when automobile bodies will be made largely of wood and competition will be so keen that cost and price will be a big factor, then the finisher will have to economize at every turn as is now necessary in the piano and furniture industry.

The automobile finisher frequently comes in contact with what is called "pitted" metal; that is, metal that is scaly or full of small pits or holes. The usual method of filling these pits is by glazing with putty; but as I said before, putty does not make a permanent job. A permanent job may be made by brushing on a coat of wood filler and sanding it smooth after it becomes hard. Do not rub it off, as is done in the case of filling wood.

A good filler for this purpose may be made as follows: Mix together two parts pure linseed oil and one part good brown japan; to each gallon of this mixture add one point of turpentine. Mix well and allow to stand for half an hour, then add sufficient pure ground silex to make a dough about as stiff as soft putty. Allow this to stand for 24 hours before using, then thin the required quantity with turpentine. The extent to which it is reduced must depend on the condition of the part to be filled—the worse the pits the heavier the filler.

This filler will also answer for filling wood, and is used as recommended for metal; in fact, as a wood filler it has no superior. It should be brushed well into the pores and should be used sufficiently heavy to thoroughly fill them. Allow it to dry until it becomes flat, then remove the surplus with excelsior.—C. M. Mackay, in Wood Worker.

On September 18 at Roosevelt Field, Long Island, Roland Rohlfs, chief test pilot for the Curtiss Aeroplane & Motor Corp., and flying one of the Curtiss "Wasp" type triplanes powered with a 12-cylinder motor, broke the world's altitude record by reaching a height of 34,610 ft. The previous record of 33,137 ft. was made in May, 1919, at Villa Coublay, France, by Adjutant Casale of the French army. All official requirements were fulfilled so that Rohlfs unquestionably will be credited with this performance by the international governing body.

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Non-Shatterable Glass An Accident Preventer

One of the useful inventions which resulted from the war was nonshatterable glass, which was produced as a substitute material for wind shields of official and other cars that had to be continuously driven, under fire or not. Driving without lights was almost as bad for then wind shields were broken by collisions or through striking obstructions.

Nonshatterable glass is made of two thicknesses of glass between which is inserted a sheet of pyralin. Glass and insert are both coated with transparent cement, then the whole is placed in a hydraulic press between heated plates and great pressure applied. As a result the product is a solid unit and shows no loss of transparency.

Taxicab companies have adopted this material for windshields extensively. Taxicab drivers are more or less irresponsible and careless, while the companies are legally responsible for injuries to passengers. Presumably this material ultimately will become standard equipment on motor cars on the basis of safety first. Statistics show that 53 per cent of injuries resulting from automobile accidents are caused by glass breakages. This new material will reduce this, as it will not break into fragments and fly when struck, but merely powders and falls to the ground within 8 in. of the point of impact.

British Design of Tailless Airplane

The London Daily News reports a statement by J. A. Corry, of Burley, Leeds, claiming that in points of stability and safety he has designed a machine which will be the safest and most flexible ever built and which can be run at speeds varying from 10 to 200 miles an hour. According to Mr. Corry in the present day machines the flexibility of the engine is mostly used to secure variations of speed, but in this machine no additional and violent structural stresses can take place even in the case of flattening out after a volplane, and as the machine has no tail, this could not be broken in climbing. He states that it would be absolutely impossible for his machine to corkscrew, overturn, or loop the loop. His design is said to involve a radical change in all known types of construction, but it still remains a true airplane, with planes of the kind now in use, and any of the aero engine or propellers already adopted. Mr. Corry intends to enter his airplane in the recently announced government competition for safe and reliable machines.

Annealing Process Prevents Growth of Cast Iron

One of the odd things which have given internal combustion engineers the world over a great deal of trouble is the phenomenon known as the "growth" of cast iron. Parts which when turned out were a proper, or even an easy fit have become tight in course of time under certain conditions, especially such as those represented by repeated heating in an oxidizing atmosphere. The explanation has been shown to be the penetration of the mass by oxidizing gases, which is made possible by the presence of plates of free graphite on the surface. This penetration, it appears, may be prevented by annealing the object in iron oxide at a temperature of between 800 and 900 deg. C. for a period of about 72 hours. The process is therefore recommended for application to dies and molds, and the valve seatings and guides of gas engines.

Current Automotive Metal and Supply Prices

General Business In general, business men have adopted a waiting attitude in both a national and international sense. Until the present era of continued strikes of all kinds, under all conditions, and on the slightest of pretexts, the outlook for good business was splendid. Even now, department and similar stores report a wonderful trade. Manufacturers, however, are waiting for the labor situation to clear up before starting in on business on a big scale, such as basic conditions warrant. They are also waiting for the peace treaty to be signed and the general clearing up of the international situation which is sure to follow this before undertaking large commitments in importing or exporting, where also present conditions point out plenty of business.

The exchange situation is against this country and its exporters, that is dollars are at such a premium as compared with all other foreign money at a large discount that the foreign buyer suffers a very large loss in buying in this country. For this reason alone much trade is going to Germany, Switzerland, Norway, Sweden, and other European countries where the exchange rates are more favorable, this being business which under any other money situation would come to this country.

These home and foreign drawbacks have resulted in hand-to-mouth buying of raw materials, supplies and equipment. Just as soon as the strike situation in this country clears up, and profitable manufacturing is possible, the basic conditions of unprecedented demand will bring a quick shift of domestic conditions. Following this improvement, the international situation will take more time to clear up. The stock market has been made strong by investment buying of a heavy order, building operations are the heaviest for two years and constantly increasing, bank deposits and clearings are very high and increasing.

Iron and Steel The big steel strike has demoralized the general ferrous metals situation, although pig iron in the first half of September showed production at 79 per cent of capacity, while ingot production in August was down to 80 per cent of capacity. The former was under strike conditions and is remarkably good; the latter was not under strike conditions and is a peculiar showing. Either the companies did not try for a large output (in the face of strenuous demands) or labor indifference prevented the production of normal tonnage.

Construction work is lagging because of the uncertainty in the matter of steel and iron supplies. Exports at present are absorbing 20 per cent of the current output.

Iron has been in such demand that spot deliveries are

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selling for $3 and $4 a ton above 1920 quotations. A few makers have marked foundry iron up $1 to $2 a ton. Malleable is in even heavier demand and the figure of $27.25 for both valley and Chicago is purely nominal. 200 tons of Bessemer valley furnace recently brought $27.95 Pittsburgh. Bars are very high and have sold for 3 cents a pound for prompt delivery from warehouse. Prompt coke is firmer and held at $4.25.

Copper Copper has been weak for some time, but following the recent absorption of all the red metal in second hands, the price has stiffened up a little, and quotations are now at 22.12½c for electrolytic and 22.62½c for lake. These figures show a continuous recession from the high of July 25 when both kinds were at 23½@24, and then were expected to go higher, perhaps through the war level of 26.

Few of the larger producers have been able to get out more than two-thirds of last year's production. Thus, Anaconda in the seven months ending August 31 produced 91,072,000 lbs. against 183,100,000 lbs. in the same period of last year.

Similarly with exports and imports; in the first seven months exports of copper were but 114,071 tons, compared with 213,495 tons in 1918. Imports were 111,000 tons in 1919 and 139,000 tons in 1918.

Lead and Antimony Although the demand for lead has been only moderate, the price has been gradually moving upwards above 6c. On September 15 the leading producer advanced its quotation ¼c per lb. to 6.25c New York, or 6c St. Louis, and the outside market at once rose to this level. Early in October the market moved up beyond this figure and 6.25@6.50c ruled. It is believed that a shortage of lead is in prospect. Late in October the leading interests were expected to advance the price again. Cut lead sheets are bringing 9c.

Antimony was not so strong, but an easy situation in September became more firm in early October, with small lots held at 8⅝, and 25-ton lots bringing 8½c. Sellers are expecting an advance and are not inclined to part with their supplies.

Tin The strike in the steel industry and the exchange situation have held back the tin market, so that it has not had the marked advance predicted for it. Demand is good but not strong. There are large amounts of tin afloat but practically all of this has been sold. The prices which ruled in September, namely 56½c per lb. for Straits spot, 55¼c for 99 per cent English, and 55¾c for American electrolytic, all New York spot, have not changed much, if any, by mid-October. Large sales of English Lamb & Flagg tin weakened the price in August, while the non-arrival of Banca and Chinese stiffened the price. Increased shipments of Straits raised the visible supply of 13,555 tons at the end of July to 18,149 tons at the end of August, although 14,069 tons of this were afloat.

Zinc In September the demand for zinc was very light and the price receded to 7.15 St. Louis or 7.50 New York, but large exports in early October put the price back again to 7.45 Prime Western spot St. Louis and 7.80 New York for the same quality on October 17.

Considerable German zinc has been offered in London at prices with which American firms can not compete. American exports in August totalled but 2,377 tons compared with more than 12,000 tons in June.

Aluminum In wholesale lots No. 1 virgin metal, 98 to 99 per cent pure, is unchanged from the September figure of 32@33c New York for early delivery. Imports during the first six months, mainly French metal, amounted to 2,910 tons. In the same period exports totalled 1,454 tons. An active market in aluminum is not expected for a long time.

Other Metals The ferro alloys have held up, due to a fair but continuous demand. Domestic ferromanganese 80 per cent is still held at $110 while English sells at $100@115 c.i.f. Spiegeleisen is nominally at $34@35, but sales have been reported below this figure. Ferrosilicon is nominal at $85@90, but sales have been made recently at $75. After many ups and downs, and actually approximating $1.21, silver has quieted down and on October 17 stood at $1.18⅛. Platinum is both high and scarce, hard metal (10 per cent iridium) is nominal at $160 an ounce, but dealers are paying $10 an ounce premium. There is very little activity in tungsten, as buyers are scarce. Chinese ore is offered at $7.25 a ton with concessions, but no takers. Quicksilver is dull and tending downward, at $80 a flask of 75 lbs.

Old Metals Except heavy lead which is up, zinc which is down slightly, and steel scrap which is in strong demand, all the old metals are stationary and buyers are not interested. Old aluminum is in good demand, while block tin scrap continues scarce.

Chemicals Industrial chemicals have been in good demand recently, except so-called naval stores and waxes. Even the naval stores rallied strongly in mid-October, turpentine and rosin leading. The heavy chemicals, judging by price inquiries, are experiencing the fall buying of supplies. Manufacturers are sufficiently busy so that 10 days is the best delivery that can be made. Petroleum products have been kept at present price levels only by extraordinary production, as the export demand continues tremendous. Any slackening in production, or anything which restricts Mexican output and importation will cause an immediate upturn of prices.

Fabrics In mid-October burlaps changed from fairly active to active, and prices stiffened, 10 oz. 40's afloat selling at 18c, with higher asked for spots, few of which are available. All cottons were higher, including cloths and waste, on a considerable rise in raw cotton, followed by a proportionate increase in cotton yarns. Tire fabrics were slightly higher in sympathy.

Other Materials The last of September rubber developed considerable strength, all grades being advanced about 5 cents a pound. Large orders are reported to have been placed by large tire manufacturers for October-December and January-June delivery. These are manufacturers who have kept out of the market, so this may be taken as their belief that it will go higher. Further evidence is seen in the fact that futures are quoted higher than spot. Leather is firm to higher, upholstery leather in particular being in strong demand. This demand, too, is expected to continue for two months. The recent drop in raw hides has not as yet been reflected in the prepared leathers. It is said that younger cattle are being killed so that the spready hides which are needed for upholstery leathers are limited in quantity. This may keep prices up. Graphite is in fair supply and the prices are stationary. Shellac and talc are quiet in a similar manner.

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The prevailing prices compared with last month's are as follows. Every effort is made to have these as accurate as possible, but none are guaranteed. Many are obtained through trade sources dealing in large quantities, so these may not be realized on smaller quantities:

		Aug. 25	Sept. 20
Acid, Muriatic, 20° (Hydrochl)	lb.	$0.01¼— .02½	$0.02 — .02½
Acid, Nitric, 38°	lb.	.07 — .08½	.07 — .08½
Acid, Nitric, 42°	lb.	.08	.08
Acid, Sulphuric, 66°	ton	22.00 —23.00	22.00 —23.00
Acid, Sulphuric, fuming	lb.	27.00	27.00
Alcohol, Wood, 97 p.c.	gal.	1.33 — 1.38	1.33 — 1.38
Alcohol, Denatured	gal.	.54 — .55	.58 — .60†
Aluminum, Metallic, in Ingots			
No. 1 99% pure, carload lots	lb.	.32 — .33	.32 — .33
Small lots	lb.		.35 — .37
Ammonium Chloride (Sal-Ammoniac) white, lump	lb.	.13½— .14	.13½— .14
Amyl Acetate	gal.	3.75 — 3.80	3.75 — 4.00
Antimony, Asiatic	lb.	.09 — .10	.08½— .09½
Babbitt Metal, best grade	lb.	.90	
Babbitt Metal, Commercial	lb.	.50	
Beeswax, natural crude, yellow	lb.	.41 — .45	.41 — .45
Benzol, pure	gal.	.25 — .29	.32†
Bismuth, Metallic	lb.	2.95	2.95
Cadmium, Metallic	lb.	1.50 — 1.75	1.50 — 1.75
Carnauba No. 1 Wax	lb.	.88 — .90	.86 — .88
Chrome Ore, 40% Min., 35% Cal. unit		.60	.60 — .80
Cobalt, Metallic	lb.	2.50 — 3.50	2.50 — 3.50
Copper, Lake, ingot	lb.	.26	.22⅝
Copper, Electrolytic	lb.	.24 — .25	.22⅛†
Copper, Casting	lb.	.24 — .25	.22 †
Glue, Common	lb.		
Glue, Fish (50 gal. bbls.)	gal.		
Glue, extra, white	lb.		
Glycerine, c. p. drums	lb.	.19 — .21	.19 — .21
Graphite, flake, Ceylon	lb.		.05 — .15§
Graphite, Madagascar	lb.		.10§
Graphite, Mexican	ton		32.50§
Iridium	oz.	175.00	175.00†
Lead, Pig	lb.	.06½— .07	.06¼†
Lead, Bar	lb.	.07½— .08	
Lead, Red, dry	lb.	.13	.13
Magnesium, Metallic		1.75 — 2.10	1.75 — 2.10
Mercury, Metallic (Quicksilver) flask		101.00	100.00
Nickel Metallic Shot and ingots	lb.	.41 — .45	.41 — .45
Paraffin, ref. 120	lb.	.07¾— .08	.07 — .08
Pitch	bbl.	8.25 — 8.50	8.25 — 8.50
Platinum Metallic	oz.	105.00 —110.00	110.00 —115.00
Potash, Caustic (85-92 p. c.)	lb.	.35 — .40	.35 — .40
Pumice, Ground (domestic)	lb.	.02½	.02½
Rosin, bbls. 280 lbs., B-D		16.80 —18.25	16.25 —17.50†
Shellac, TN	lb.	1.20	1.20
Orange, superfine	lb.	1.35	1.35
Bleached, bone dry	lb.	1.40	1.40
Silver, Fine	oz.	1.12½	1.18⅛*
Sodium Hydrate (Caustic Soda) 76 p. c.	100 lb.	2.90 — 3.50	3.45 — 3.50†
Solder, half and half	lb.	.43	.40
Solder, No. 1	lb.	.38	.36
Solder, Refined	lb.	.33	.31
Sulphur (crude)	ton	22.00	22.00
Tin, Metallic straights pig	lb.	.55 — .60	.55½†
Tungsten, Scheelite, per unit	ton	9.00 —12.00	9.00 —15.00
Wolframite, per unit	ton	7.00 —10.00	7.50 —10.00
Turpentine, spirits of crude		1.75	1.70†
Zinc, Western Spelter	lb.	.08½	.08½
No. 9 base casks, open	lb.	.12½	.12½

*Oct. 17. †Oct. 14. §Oct. 20.

OLD METALS

Dealers' purchasing prices paid in New York are as follows:

	Sept. 16	Oct. 15
Copper, heavy and crucible	17.00	22.00
Copper, heavy and wire	16.00	20.00
Copper, light and bottoms	14.00	18.00
Brass, heavy	10.50	14.50
Brass, light	7.50	11.00
Heavy machine composition	15.50	20.00
No. 1 yellow brass turnings	10.00	12.75
No. 1 red brass or composition turnings	11.50	16.00
Lead, heavy	4.75	5.50
Lead, tea	3.75	4.25
Zinc	5.00	6.00
Heavy steel scrap, Pittsburgh	19.50	19.00
Heavy steel scrap, Philadelphia	18.50	19.00
Heavy steel scrap, Chicago	18.50	17.50
No. 1 cast, Pittsburgh	23.50	24.00
No. 1 cast, Philadelphia	25.00	25.00
No. 1 cast, Chicago (net ton)	23.50	23.50
No. 1 RR. wrought, Philadelphia	26.50	27.00
No. 1 RR. wrought, Chicago, net	19.00	18.00

PIG IRON

Per Gross Ton:	Sept. 16	Oct. 14
No. 2 X, Philadelphia§	$30.60	$32.10
No. 2, Valley furnace†	26.75	26.75
No. 2, Southern, Cincinnati†	31.10	31.60
No. 2, Birmingham, Ala †	27.75	28.00
No. 2, furnace, Chicago*	26.75	26.75
Basic, delivered, eastern Pennsylvania	26.60	28.00
Basic, Valley furnace	25.75	25.75
Bessemer, Pittsburgh	29.35	29.35
Malleable Bessemer, Chicago*	27.25	27.25
Malleable, Valley	27.25	27.25
Gray forge, Pittsburg	27.15	27.15
L. S. charcoal, Chicago	32.75	32.75

*The average switching charge for delivery to foundries in the Chicago district is 50c per ton.
†Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.

IRON AND SOFT STEEL BARS

	Sept. 10	Oct. 10
Bars:	....	....
Merchant iron, base price	3.37c	3.37c
Refined iron, base price	6.10c	6.10c
Burden's H. B. & S. bar iron, base price	6.30c	6.30c
Burden's best bar iron, base price	20.00c	20.00c
Norway bars, base price		
Soft Steel:		
¾ to 1⅞ in., round and square	3.37c	3.37c
1 to 6 in. x ⅜ to 1 in.	3.37c	3.37c
1 to 6 in. x ¼ and 5/16	3.47c	3.47c
Rods—⅝ and 11/16	3.42c	3.42c
Bands—1½ to 6 x 3/16 to No. 8	4.07c	4.07c

BOLTS, NUTS AND RIVETS

	Sept. 5	Sept. 25
Large structural and ship rivets	$3.90 base	$3.90 base
Large boiler rivets	4.00	4.00
¼ in., 5/16 in. and 7/16 in.	% off list	% off list
Machine bolts h.p. nuts, ⅜ x 4 in.:	60-5	60-5
Smaller and shorter, rolled threads		
Cut threads	60	60
Larger and longer sizes	50-10	50-10
Machine bolts, c.p.c. and t. nuts, ⅜ x 4 in.:	45-5	45-5
Smaller and shorter	40-10-5	40-10-5
Larger and longer	40	40
Carriage bolts, ⅜ x 6 in.:		
Smaller and shorter, rolled threads	50-10	50-10
Cut threads	50	50
Larger and longer sizes	40-5	40-5
Lag bolts	60	60
	per lb. off list	per lb. off list
Hot pressed nuts, sq. blank	3.10c	3.10c
Hex., blank	3.10c	3.10c
Sq., tapped	2.85c	2.85c
Hex., tapped	2.85c	2.85c
C.p.c. and t. sq. and hex. nuts, blank	3.10c	3.10c
C.p.c. and t. sq. and hex. nuts, tapped	2.85c	2.85c
Semi-finished hex. nuts:	% off list	% off list
⅝ in. and larger	70	70
9/16 in. and smaller	75-10	75-10
Stove bolts in packages	75-10	75-10
Stove bolts, bulk	75-10-2½	75-10-2½
Tire bolts	60-10	60-10

The above discounts are from lists in effect August 4.
All prices carry standard extras.

BRASS AND COPPER SHEETS AND SHAPES

		Sept. 10	Oct. 10
Copper sheets, hot rolled	lb.	$0.33½	$0.33½
Copper sheets, cold rolled	lb.	.35	.35
Copper bottoms	lb.	.41½	.41½
Copper rods	lb.	.24	.24
Copper wire	lb.	.25	.26
High brass wire and sheets	lb.	.27¼	.27¼
High brass rods	lb.	.26¼	.26¼
Low brass wire and sheets	lb.	.30½	.30½
Low brass rods	lb.	.31¼	.31¼
Brazed brass tubing	lb.	.39	.39
Brazed bronze tubing	lb.	.44¼	.44¼
Seamless copper tubing	lb.	.37½	.37½
Seamless bronze tubing	lb.	.40	.40
Seamless brass tubing	lb.	.36	.36

FERROALLOYS

	Oct. 6	Oct. 20
Ferromanganese, 80% delivered producers' price	$110.00	$110.00
Ferromanganese, 80%, English c.i.f. Atlantic ports	100.00 to 105.00	100.00 to 105.00
Spiegel, 18% to 22% furnace, spot	34.00 to 35.00	34.00 to 35.00
Ferrosilicon, 50%, spot and contract, delivered	85.00 to 90.00	80.00 to 85.00
Ferrotungsten, standard, per lb. contained, furnace	1.20 to 1.30	1.25 to 1.30
Ferrochrome, 60% to 70% chromium, 4% to 6% carbon, per lb. contained, maker's plant	28 to 30 cents	22 to 24 cents
Ferrovanadium, 35% to 40% per lb. contained, according to analysis	$6.00 to $7.50	$6.00 to $7.50
Ferro carbon-titanium, carloads, producer's plant, per net ton	200.00	200.00
Bessemer, ferrosilicon, 10%	49.75	49.75
Bessemer, ferrosilicon, 11%	53.05	53.05
Bessemer, ferrosilicon, 12%	56.35	56.35

Ferrosilicon prices at Ashland, Ky., Jackson and New Straitsville, O.

CRUDE RUBBER

		Sept. 10	Oct. 15
Para, Upriver fine	lb.	$0.54½—$0.55½	$0.52 —$0.52½
Upriver coarse	lb.	.31½—	.31 — .32¼
Upriver caucho ball	lb.	.31 — .32	.32 — .32½
Plantation, first latex crepe	lb.	.44 — .45	.49½— .50
Ribbed smoked sheets	lb.	.43 — .43½	.48½— .49
Brown crepe, thin, clean	lb.	.38 —	.43½— .44
Amber crepe No. 1	lb.	.40½— .41	.47 — .48

PETROLEUM PRODUCTS

	Oct. 20
Oil—Pennsylvania Crude	$4.25
North Lima Crude	2.48
Kansas and Oklahoma Crude	2.25
Healdton, Crude	1.20
California Crude, 37-37.9	1.67
Ref. 150 Test, Dealers	.22
Tanks, wagon to store	.16
Fuel, 28-31 deg	.14
Gas, 34 deg	.15
Gasoline, Motor, garages, steel bbls	.24½
Consumers, steel bbls	.26½
Lubricating Oil, black, 29 gravity	.25— .30
Cold test	.20— .22
15 cold test	.20— .22
Cyl. light filtered	.44— .45
Dark filtered	.40— .41
Extra cold test	.50— .54
Dark, steam ref	.30— .34

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Men of the Automotive Industry

Who They Are What They Are What They Are Doing

L. H. Earle has been appointed eastern representative for the Buda Co., Harvey, Ill., with offices at 1216 Aeolian Hall, 33 West 42d street, New York. He was formerly connected with the Continental Motors Corp., first as designing engineer and later as sales manager. Previous to that he was chief engineer of the Abbott Motor Car Co. and with Chalmers at Detroit. He was released from service last spring as captain in the ordnance corps. Previous to service he was in business for himself as Earle & Boggs, Inc., manufacturers' representatives.

Theodore T. Lane, until recently a lieutenant in the United States Air Service, has been appointed director of purchases for Briscoe & Stahl, Detroit, American representative of Bollanger Freres. His previous experience in automotive lines includes connections with the Maxwell-Briscoe Co., Tarrytown, N. Y.; the United States Motor Co., New York; Maxwell-Briscoe Co., Newcastle, Ind.; and the Briscoe Motor Co., Jackson, Mich. He has also been connected with Dodge Bros., Detroit.

Dr. George C. Barlow has resigned as president of the U. S. Tractor Co., Menasha, Wis., because of ill health, and is succeeded by Joseph G. Sailor, whose place as vice-president is filled by E. M. McGillan, mayor of Menasha. The company was organized early this year to take over the business of a company of similar name at Chicago. A new plant has been erected and equipped and has been manufacturing the Uncle Sam tractor in quantities since June.

H. H. Hills, assistant general manager Packard Motor Car Co., has been promoted to vice-president in charge of distribution. He was general sales manager for several years, joining the company in 1908. George R. Bury has been made general distribution manager. A year ago he was sent to Chicago to head the Packard Motor Co. of Chicago, before that being carriage sales manager for the company.

Major George R. Wadsworth has been elected second vice-president and director of the United Aircraft Engineering Corp. Major Wadsworth is in charge of transportation development work which includes the establishment of municipal landing fields and air routes in all parts of the country for passenger carrying and light express. Charles M. Vought has also been elected a director.

W. W. Wildman has resigned as treasurer and general manager of the Portage Rubber Co., Barberton, O. His future plans have not been announced. He has been connected with the Portage company for the past eight years, having gone to Akron to take charge of the Aladdin Rubber Co., which later merged with the Portage company. His successor has not been named.

C. C. Van Wagner has been elected secretary of the Victor Truck Mfg. Co., St. Joseph, Mich., and will have direct charge of the operating end of the local concern. Van Wagner is reported to have purchased a substantial interest in the company. Louis C. Koontz, of St. Joseph, has been secured to take charge of the mechanical department.

V. L. Curran has resigned as purchasing agent of the Sparks-Withington Co., Jackson, Mich., and has acquired an interest in the Jackson Screw Products Co. He assumed the duties of general manager September 15. Curran is succeeded by James T. Beadle, for many years a buyer for several Jackson automobile manufacturers.

J. R. Harbeck, vice-president of the American Can Co., and particularly identified with the affairs of the Duesenberg Motors Corp., as its president, has been made vice-president and general manager of the Willys Corp., in charge of the Duesenberg plant at Elizabeth, N. J., at which the new Willys Six car is to be manufactured.

S. S. Newton, president of the Luther Grinder Mfg. Co., Milwaukee, has resigned and will retire because of advanced age. W. T. Hardy has been elected a director and president of the corporation. The business was founded 21 years ago. Mr. Newton is 68 years old and was active in the management for 18 years.

Alwin A. Gloetzner, formerly vice-president in charge of sales and engineering of the Covert Gear Co., Inc., Lockport, N. Y., has been appointed manager of the company, succeeding P. A. Clum. He will spend four days each week at the Lockport plant and the balance of his time in Detroit.

Harry J. Lindsley, who has been western sales manager of the Bound Brook Oil-less Bearing Co., Bound Brook, N.J., for the last seven years, and William F. Jennings, who has been eastern sales manager for the last five years, have been made vice-presidents.

D. F. Edwards has resigned as secretary and treasurer of the Gier Pressed Steel Co., Lansing, Mich., to become affiliated with the Willys Corp. at the Dusenberg plant, Elizabeth, N. J. He will be one of the active executives of the new Willys organization.

O. P. Wilson, who has been assistant general manager of the Norma Co. of America for several years, was elected vice-president of the company at a recent meeting. W. M. Nones continues as president and treasurer in executive charge of affairs.

John Kopf, formerly with the Bureau of Aircraft Production, Dayton, O., has been appointed manager of the engineering department of the Duff Mfg. Co., N. S., Pittsburgh, manufacturer of lifting jacks and other specialties.

George W. Mixter has been appointed vice-president and general manager of the Pierce-Arrow Co., Buffalo, N. Y. He comes to the Pierce-Arrow Co. from Deere & Co., and will still retain his official capacity in that company.

William E. Richards, patent attorney, New York, announces that Oscar E. Geier has been admitted to partnership and the name of the firm changed to Richards & Geier. The address, 277 Broadway, remains unchanged.

L. S. Skelton, Okmulgee, Okla., has been elected president of the Premier Motor Corp., Indianapolis, of which he recently acquired 65 per cent of the stock. Frederick P. Nehrbas has been named general manager.

John Kelly, formerly New York district manager of the Edison Storage Battery Co., has been appointed general manager of the same company. He will make his headquarters at Orange, N. J., home of the firm.

Guy Morgan, formerly supervisor of plant survey and chief of production for the Motor Transport Division, U. S. A., is now vice-president and general manager of the American Motors Corp., Newark, N. J.

Jay V. Hall, formerly general sales manager of the Olds Motor Works, who resigned that position some time ago, is now with the new Willys Corp. and is located at the Duesenberg plant where he is in charge.

H. M. Thomas, for many years superintendent of the Anderson Engine Co., 4036 N. Rockwell street, Chicago, Ill., is now production engineer of the United States Tractor & Machinery Co., Menasha, Wis.

Pierce G. Smith has been appointed vice-president of the American Malleables Co., of Lancaster, N. Y., and Owosso, Mich. He formerly held the position of sales manager with this organization.

W. B. Condit has accepted a position as chief draftsman for the Nelson Motor Truck Co., Saginaw, Mich. Mr. Condit was formerly of the engineering staff of the Gramm-Bernstein Motor Truck Co.

Robert M. Sanderson is now general superintendent for the Amazon Tire & Rubber Co., of Akron, O. Mr. Sanderson was superintendent of raw materials of the Miller Rubber Co.

L. P. Helm, for two years in charge of production of the Olympian Motors Co., Pontiac, has resigned to become production engineer of the Chief Motors Corp., Port Huron, Mich.

Paul Sutcliffe is now manager of the industrial truck and tractor department of the Edison Storage Battery Co., Orange, N. J. Mr. Sutcliffe was formerly advertising manager.

L. C. Freeman has been made executive engineer of the Maxwell Motor Co. He will be in charge of the engineering departments of both the Maxwell and Chalmers plants.

B. W. Twyman has been appointed manager of the factory now being constructed by the Nash Motors Co. in Milwaukee for the manufacture of a new four-cylinder car.

E. M. Champion, formerly factory manager Bay City plant, C. R. Wilson Body Co., has been made factory manager in charge of production, with headquarters in Detroit.

Joseph E. Otis, vice-president of the Central Trust Co. of Illinois, has been elected a director of the Stewart-Warner Speedometer Corp., Chicago.

Hal T. Boulden has been elected vice-president of the Selden Truck Corp., of Rochester, N. Y., and will have charge of sales and advertising.

J. Fletcher Farrell was elected a director of the Briscoe Motor Corp., Jackson, Mich., at a meeting of the board of directors.

Walter Shaw, Racine, Wis., is superintendent Logansport Body Works, a concern recently formed in Logansport, Ind.

Arthur C. Brenckle has been made secretary and general manager of the Olympian Motors Co., Pontiac, Mich.

William P. Anderson has become assistant general manager of the Olds Motor Works, Lansing, Mich.

Geo. D. Gordon has been made president of the newly organized Selden Truck Corp., Rochester, N. Y.

Chas. F. Barth has been promoted to general manager of the Chevrolet Motor Co., Flint, Mich.

C. F. Hepburn has been made president and general manager of the Republic Motor Truck Co.

C. G. Rowlette has succeeded C. W. Dickerson as treasurer of the Timken-Detroit Axle Co.

Charles F. Van Sicklen has resigned as secretary of the Van Sicklen Speedometer Co.

L. N. Burns has been elected president of the J. I. Case Plow Works, Racine, Wis.

OBITUARY

Charles E. Lord, general patent attorney and manager of patent department International Harvester Corp., died suddenly as a result of an automobile accident September 25. He was motoring to the Deering plant with W. F. Piper, an inventor whose process was under experiment there and inside the plant the car was struck by a switching engine. He was born in Somerville, Mass., in 1875 and was a graduate of Mass. Inst. of Technology. He was a fellow fo the American Institute of Electrical Engineers, a member of the American Society of Mechanical Engineers, Society of Automotive Engineers, Engineers' Club of Chicago, American Patent Law Association, University Club of Washington, D. C., and other technical and social organizations. Mr. Lord was association editor of the Encyclopedia of Engineering and wrote several text books for this publication when it was getting under way. He was a lecturer on patent law at Marquette University, and during the days of the war was a member of the war committee of the Technical Societies of Chicago. For two years and until recently he was chairman of the committee on patents of the National Implement and Vehicle Association.

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Activities of Automotive Manufacturers

Where They Are Located What They Are Doing How They Are Prospering

General Tractors, Inc., New York and Chicago, has been incorporated in Delaware with a capital stock of $1,500,000 as a reorganization and consolidation of the Monarch Tractor Co., Watertown, Wis.; Monarch Tractor Co., South Dakota, and Monarch Tractor, Ltd., Brantford, Ont. The main works were established at Watertown about three years ago. Later a Canadian plant was opened at Brantford. In April, this year, the concern acquired the plant and business of the American Standard Products Corp., Paulsboro, N. J., covering an area of 17 acres. The New Jersey plant is being converted for the production of a new two-wheel garden type tractor and a 9-16 h.p. machine. The Watertown plant, manufacturing the heavier types, will increase its capacity from five machines a day to ten by the installation of considerable new machine tool equipment in extensions which have been erected the past year. The Canadian works also will be enlarged to provide additional capacity for the heavier types of machines. W. N. Smith, Watertown, Wis., is president and general manager.

Nash Motors Co., Kenosha, Wis., which is about to establish a branch factory in Milwaukee, has purchased 46 acres, with a frontage of 811 ft. on Clement avenue, and bounded by the main line and the Milwaukee belt line of the Chicago & Northwestern Railroad, south of Oklahoma avenue. Work will begin at once on the erection of a factory for producing passenger automobiles, which ultimately will represent an investment of $3,500,000 and provide employment for 4,000. A four-cylinder touring car will be manufactured and the layout is on the basis of a daily output of 100 machines, with facilities for a maximum production of 200 machines a day. The first units will consist of a machine shop, an assembling floor, and a boiler house. The main works in Kenosha will be continued in full operation, being devoted to the manufacture of six-cylinder passenger cars and motor trucks.

Cole Motor Car Co., Indianapolis, will add two new buildings to its plant at Washington and Davidson streets, which will double its size and give an output of 6,500 passenger cars by the end of the year and 12,000 in 1920. The expansion will involve an expenditure of $1,000,000. The first building, to be completed by January, will be five stories, 180 x 228 ft., and will contain the storage, shipping, supply, repair and paint departments. The second building will be a duplicate of the present plant, 132 x 212 ft., four stories and basement, to be used for production work. When completed the company will have almost 500,000 sq. ft. of floor space. J. J. Cole is president; S. J. Kuqua, vice-president, and J. F. Morrison, secretary-treasurer.

Lafayette Motor Co. is the corporate name of the new company formed under the laws of Delaware with a capital of $4,000,000 or 40,000 shares of preferred stock (total authorized 60,000 shares) and 40,000 shares of common stock of no par value, to manufacture the new car designed by D. McC. White, former chief engineer of the Cadillac company and designer of the Cadillac eight. A modern three-story fireproof building has been purchased in Indianapolis with a 25-acre plot. The machine will be a "first quality passenger car" according to the announcements. The officers of the new company are: C. W. Nash, Kenosha, Wis., president; J. J. Storrow, Boston, chairman, and D. McCall White and E. C. Howard, vice-presidents.

Willys Corporation, New York, has been organized by John N. Willys, head of the Willys-Overland Co., Toledo, O., with capital of $25,000,000 to manufacture a new six-cylinder automobile. The company has acquired the plants of the Duesenberg Motors Corp., Newark avenue, Elizabeth, N. J., and at Poughkeepsie, N. Y., which have been used for the manufacture of high-speed motors for government and other service. It is expected to increase the present plant capacities by enlargements. The new Willys Corp. will also be interested, it is understood, in the other Willys interests, including the New Process Gear Corp., Syracuse, N. Y., and the Electric Auto-Lite Corp., Toledo.

Jackson Motors Corp., Jackson, Mich., has been organized with capital of $5,000,000, to merge the Jackson Motor & Mfg. Co. and United Four Wheel Drive Truck Corp., Chicago, and arrangements have been perfected to increase the capacity of the local plant to develop an output of 4,000 passenger automobiles and 1,250 trucks during the coming year, with addition of 10,000 sedan and coupe bodies to be built for the General Motors Corp. Considerable machinery from the Chicago and Port Jefferson plants will be installed at the local works, with the addition of such new equipment as is required. About 1,000 additional operatives will be employed. H. A. Matthews is president.

Haverford Cycle Co., 503 Market street, Philadelphia, has purchased the plant of the Savage Arms Corp. at Erie avenue and Sepviva street, which has been held for sale at $500,000. The property comprises about 7½ acres of land, with seven plant buildings and power plant. It was acquired by the Savage Arms Corp. from the Isaac A. Sheppard Stove Works during the war period. The new owner will equip it for the manufacture of motorcycles and bicycles, and will give employment to about 1,500 persons. The plant will be run under the name of the Ace Motorcycle Mfg. Co. Max M. Sladkin is president of the Haverford company.

DuPont Motor Mfg. Co., 904 Market street, Wilmington, Del., has commenced the erection of a machine shop, 60 x 250 ft., on Commerce street, to form the first building of its proposed plant for the manufacture of automobiles. Active operations will begin within a month, allowing for the completion of cars in November. The works will specialize in runabouts, and four and five-passenger car models, weighing about 3,150 lbs. E. Paul duPont is president and John A. Pierson, chief engineer.

Fremont (O.) Motors Corp. has been organized for the manufacture of passenger car and trucks. The company is capitalized at $2,000,000 and has purchased the plant of the Burford Motor Truck Co. and will continue the manufacture of the Burford truck. It will specialize in the manufacture of a four-passenger car which will sell at $1,285. Fred M. Guy will be sales manager of the concern. C. Whitmore, formerly of the Packard Motor Car Co., is in charge of factory management.

J. I. Case Plow Works, Racine, Wis., has been incorporated in Delaware with an authorized capital stock of $5,000,000 first preferred, $5,000,000 second preferred, and 125,000 shares of common without par value. The new corporation effects the consolidation of the J. I. Case Plow Works and the Wallis Tractor Co., both of Racine, Wis., the ownership and management of which have been largely identical. H. M. Wallis is president and general manager.

Wichita Falls (Tex.) Motor Co. has leased the plant of the Midland Motor Car & Truck Co. at Oklahoma City, Okla., and this will be used for the production of the 1½ and 2½ ton trucks and the Oil Field Special models. It is expected that 2,500 of the last two will be turned out from this new plant. Other models will be continued at the Wichita Falls plant, but operations there are restricted due to a housing shortage produced by an oil boom.

H. H. Franklin Mfg. Co., Syracuse, N. Y., has arranged for the immediate erection of the proposed addition to its plant at Marcellus and Magnolia streets, to consist of a seven-story works, 120 x 240 ft., to cost about $400,000, including machinery. It is proposed to increase the present output from about 11,200 a year to 18,000 automobiles a year. It is expected to have the new structure ready for occupancy early in December.

Collins Motor Co., Inc., has located its temporary offices at Huntington, L. I., and is planning to build a large factory for the manufacture of motor cars. A. H. Collins, formerly vice-president of the R. C. H. Corp., is president. Other officers include W. B. Brewster, vice-president; Spencer C. Smith, treasurer; Chas. H. Stool, secretary and general counsel. These men, with Henry S. Brush, form the directorate.

White Co., Park avenue and 57th street, New York, manufacturer of automobiles, with headquarters at Cleveland, O., has awarded a contract for its proposed one, two and four-story works building, reinforced concrete and brick, 200 x 400 ft., on the block bounded by Thompson and Mott avenues, Mount and Selon streets, Long Island City, N. Y.

Owen Magnetic cars are soon to be built in a factory devoted entirely to their manufacture. The International Fabricating Co. has purchased and equipped the Matheson automobile factory at Wilkes-Barre, Pa., to turn out Owen Magnetic cars. The production is to be in charge of W. N. Dennison, president of the International Fabricating Co.

L. M. Helfner Mfg. Co., Philadelphia, has been incorporated with a capital of $1,500,000 to manufacture farm tractors and passenger cars. The tractor for small farms will be composed of standard parts and will sell for $1,000 complete. They will manufacture a complete line of passenger cars. The chassis will be assembled from standard units.

Brockway Motor Truck Co., 544 West 38th street, New York, has developed a new type of truck for handling coal, and is devoting a portion of its plant to the production of this new machine. The front axle of the truck is placed under the center of the engine, giving a smaller turning radius with a more powerful vehicle.

Anderson (S. C.) Motor Co., manufacturer of automobiles, is planning for the erection of an addition, 250 x 350 ft., to be equipped with machinery to provide an increased output of about 30 cars per day. The company recently increased its capital stock from $2,625,000 to $3,625,000. J. G. Anderson is president and manager.

Partridge Tractor Co., 701 Heard Building, Jacksonville, Fla., recently incorporated with a capital stock of $100,000, will operate a local assembling plant for completed farm tractors. The initial works will have a daily capacity of about 100 machines. Charles E. Burrows is president and manager.

Parenti Motors Corp., Buffalo, N. Y., has been incorporated with a capital of $2,500,000 to manufacture passenger cars of laminated or ply wood construction, without a steel frame. J. S. Parenti, formerly with Fiat company of Italy, is president; W. K. Wishart, secretary and treasurer.

Preston Motors Corp., Birmingham, Ala., recently incorporated with $1,000,000 capital, has secured a 40-acre tract and will soon start to manufacture a six-cylinder car. R. A. Skinner, Detroit, is president and engineer; Preston Orr, Montgomery, Ala., secretary and treasurer.

Hudson Motor Car Co., Detroit, has about completed negotiations for the purchase of 48 acres adjacent to its present factory site. This property, with the 15 acres of its present site, will be used for plant extensions. The investment in the new plant site is to be about $500,000.

Handley Page, Ltd., Morrisburg, Ont., has been incorporated with a capital stock of $2,500,000 by William H. Workman, Mark Kerr, both of London, England; Fred R. Chalmers, William H. McGannon, Morrisburg, Ont., and others to manufacture airplanes, motors, engines, etc.

Paige-Detroit Motor Car Co., Detroit, has purchased 31 acres of land adjacent to the Detroit Terminal Railway and will start the first unit of its new plant. When this is completed production in pleasure cars will be increased 125 per cent.

Consolidated Motor Car Co., Bradford, Conn., has been incorporated in Delaware with capital stock of $750,000 by Albert E. and Bert E. Lazaro, and Frank J. Kenny, all of Bradford, to manufacture automobiles.

International Motors Co., Allentown, Pa., has awarded a con-

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tract for a one and two-story reinforced concrete addition, 300 x 600 ft., with wing 60 x 300 ft., estimated to cost $1,000,000 with equipment.

Hamilton Motors Co. is the new corporate name of the Panhard Motors Co., Grand Rapids, Mich. The name of the truck produced by the company has been changed to Apex.

Motor Activator Corp., Roanoke, Va., has been incorporated with a capital stock of $25,000 to manufacture motor trucks. Roy F. Dowdy is the principal incorporator.

Transport Motor Truck Co., Mt. Pleasant, Mich., moved into its new plant on October 1. The new building has 52,000 sq. ft. of floor space ready for immediate use.

Paige Detroit Motor Car Co., Fort street, Detroit, is taking bids for the erection of an addition to its machine shop at Warren avenue and Lonyo road.

Jordan Motor Car Co., Cleveland, has purchased the adjoining plant of the Metal Parts Mfg. Co., which it will occupy for manufacturing purposes.

Chevrolet Motor Car Co., Fort Worth, has arranged for the erection of an addition to its local plant to cost about $500,000, including equipment.

Union Truck Co., Bay City, has secured a site of 42 acres for its new plant in the Riverside Park section upon which buildings will be erected.

Parts Makers

Continental Axle Co., Edgerton, Wis., has been incorporated with a capital stock of $200,000 to manufacture axles for motor trucks, trailers, etc. Work began August 20 on the erection of a brick, steel and concrete machine shop, 200 x 300 ft., which is expected to be ready about October 25. The Continental company has purchased the machinery and stock of the department of the Higgins Spring & Axle Co., Racine, in which is carried on the manufacture of axles for motor trucks, tractors and trailers, and will move it to Edgerton. The Higgins company will continue to make springs of all kinds and axles for horse-drawn vehicles. James W. Menhall, vice-president and general manager Highway Trailer Co., Edgerton, is the moving spirit in the Continental company.

A. O. Smith Corp., Milwaukee, has decided to proceed with plant additions estimated to cost $4,000,000, increasing the capacity 100 per cent. Plans are in process for new buildings with an aggregate area of 400,000 sq. ft., of brick and steel, equipped for the production of pressed steel frames for passenger cars and motor trucks; pressed steel shapes, drop forgings, axle housings, etc. A tract of 20 acres adjacent to the present works at 27th and Hopkins streets has been acquired for the extensions. L. Raymond Smith is president and general manager.

Continental Axle Co., Edgerton, Wis., incorporated with a capital stock of $200,000, has perfected its organization by the election of the following officers: President, Andrew McIntosh; vice-president, James Higgins, Racine, Wis.; secretary, E. Z. Menhall; treasurer, William McIntosh; general manager, James W. Menhall. Ground has been broken for a one-story machine shop and assembling floor, 68 x 290 ft., to be ready November 10, and equipped for manufacturing motor truck, tractor and trailer axles.

Remmel Mfg. Co., Kewaskum, Wis., has been incorporated with a capital stock of $50,000 to take over and develop the foundry and machine shop business of Nicholas Remmel, and enlarge the present line of products from gas engines and farm implements to include concrete mixers, corn huskers, grinders and other power farm machinery. Mr. Remmel continues his connection with the business as president and general manager.

Fuller & Sons Mfg. Co., Kalamazoo, Mich., maker of motor truck transmissions, during 1920 will greatly expand its capacity. The structure on Pitcher street will be completed by the addition of a third unit identical with the first two, which will add 40,000 sq. ft. The building will be four stories with concrete floors and is expected to be ready for the installation of machinery by the autumn of 1920. Frank D. Fuller is president.

Oliver Rim Co., Atlanta, Ga., recently organized with a capital stock of $1,000,000, is planning for a new plant on a 14-acre site, recently acquired. The initial works will provide about 15,000 sq. ft. of manufacturing space, to be equipped for an output of about 500 rims per day. A second unit of like size and capacity is to be constructed at a later date. Elmer Oliver is president.

Champion Ignition Co., Flint, Mich., will expend $1,000,000 for additions, machine tool equipment and other extensions. Present production is said to be about 80,000 spark plugs a day, which is expected to be increased to about 200,000 a day. The feature of the new plant will be the establishment of a continuous assembly system, along the line of the Ford Motor Co.

Wheeler Automatic Transmission Co., Indianapolis, has been incorporated with $500,000 capital stock to manufacture an automatic transmission, said to do away with shifting gears in automobiles. The officers are George W. Ray, president; J. M. Milner, secretary-treasurer; William S. Bennett, William L. Brock and William D. Benjamin, directors.

New Departure Mfg. Co., Bristol, Conn., manufacturer of ball bearings, is said to be negotiating with the Colt Patent Firearms Mfg. Co., Hartford, Conn., for the purchase of its branch at Meriden. The New Departure company is planning for extensive increase in operations.

Spicer Mfg. Corp., S. Palinfield, N. J., is reported to have purchased Sheldon Spring & Axle Co., Wilkes-Barre, Pa., and Parish Mfg. Co., Reading, Pa. The Spicer company specializes on universal joints and driving shafts, the Sheldon company in worm drives, front and rear axles and springs, and the Parish concern in frames.

E. W. Bliss Co., Adams and Plymouth streets, Brooklyn, manufacturer of presses, etc., has acquired from the Pennsylvania Railroad a block of waterfront property, near the Long Wharf, Sag Harbor, Long Island, with four-story mill building now on site. The Bliss company now has a machine shop on part of the property.

T. W. Warner Co., Muncie, Ind., manufacturer of transmissions, gears and other parts, has been absorbed by General Motors Co., and hereafter will be known as Muncie Products Co. The plant will be enlarged.

Body Builders

Fisher Body Corp., Detroit, proposes to build a Canadian plant for Fisher bodies, to be erected on land recently secured at Windsor, Ont. The building is to be the largest manufacturing structure in the city, covering practically a city block and providing employment for some 200 men and girls. The company will also build a new six-story plant in Detroit. The building will cover an area 150 x 580 ft. on Piquette avenue, between Hastings and St. Antoine streets. Its estimated cost is placed at $955,000.

Fisher Body Co., Detroit, has decided to erect a very large plant in Cleveland for the manufacture of automobile bodies. It is planned to make this the largest single unit of its kind in the world, with 7,000 employes. No details are available as to whether General Motors will purchase this firm or not, an offer having been made according to reports, but it is not improbable that General Motors interests are behind the new move.

Liberty Works, of Egg Harbor City, N. J., is manufacturing a line of body fittings for automobile body builders. Many products are included in its line, among them various types of cowl lights, tonneau bowl lights, dome lights, a rear view mirror known as the Liberty adjustable mirror-scope, which is mounted just above the windshield, corner lights, step lights, various styles of rear tonneau lights, dash lights and bouquet holders.

Indianapolis Body Corp., Indianapolis, has been formed by Harry B. Millspaugh and Clarence R. Irish to build automobile bodies. The former Overland factory building at Oliver avenue and White River boulevard has been leased for a period of seven years. The president and vice-president of the new concern are the members of the firm of Millspaugh & Irish, body builders, but the new concern will be kept entirely separate.

L. C. Graves Co., Inc., Springboro, Pa., manufacturers of commercial car and truck bodies, have just completed an addition to their plant which will increase their production 50 per cent. This addition will be used by the machining and ironing shops. Besides this, the company is spending about $30,000 in new machinery and the electrification of the entire plant, with individual motors on all machines.

Buffalo (N. Y.) Body Corp., recently organized with a capital of $1,000,000 by K. B. McDonald, formerly of the Curtiss Aeroplane Co.; R. J. McKenzie, W. R. Daniels and others, has completed arrangements for occupying the former plant of the American Seating Co., at Seneca and Lord streets and Fillmore avenue, which it will equip for the production of steel bodies.

Waterloo (N. Y.) Body Corp. has been incorporated for the purpose of manufacturing and repairing bodies for motor vehicles. The capital stock of the new corporation is $200,000, consisting of stock of $100 par value. Directors elected to serve for the first year are: A. W. Frantz, of Youngstown, O.; John Kropf, Waterloo, and T. E. Milliken, also of Youngstown.

Commerce Motor Truck Co., Detroit, has added a new body form to its line of equipment in the Economy combination steel dump and express body. This is suitable for one and two ton chassis, and holds 54 cu. ft. Dumping is by means of a simple worm and gear hoist which does not interfere with the body when used for express work.

Cincinnati Panel Co. has changed the name of the concern to The Cincinnati Auto Body Co. They make a specialty of manufacturing demountable tops and closed body work, and are having a very satisfactory trade. The officers of the company are B. H. Linnemann, president, and John R. Linnemann, secretary and treasurer.

Erdman-Guider Co., Detroit, maker of automobile bodies and capitalized at $500,000, will move its plant to Saginaw and occupy the works formerly used by the Bransfield-Billings Co., which contains 300,000 sq. ft. of floor space. Arno R. Guider is president.

Martin-Parry Corp., York, Pa., and Indianapolis, Ind., has indicated its intention to branch out and be a big factor in the trade by establishing the first of a chain of assembling plants at Buffalo, Boston and Chicago. The parent plants are working to capacity.

Edson & Blackburn Co. is the new name of the A. J. Simpson Co., Omaha, Neb., now producing automobile bodies and upholstering. This pioneer firm was established in 1858 by A. J. Simpson and was the first carriage and wagon building shop in Omaha.

Field Mfg. Co., Owosso, Mich., is making plans for an output of at least 100,000 commercial truck bodies in 1920, and to this end will establish distributing centers in the principal cities. J. F. Field is president and E. J. Frederick general manager.

Wallis Coach & Carriage Co., Minneapolis, has been granted a permit to erect a $100,000 factory at University and Bedford avenues, and construction will be started at once so the buildings will be ready for occupancy early in 1920.

Logansport Body Works, with $150,000 capital, has been formed at Logansport, Ind., to manufacture automobile bodies, and its entire output for the first year has been contracted for by the Revere Motor Car Corp.

Southwick-Pom Co., manufacturer of commercial motor car bodies, has been purchased by the Bennett-Sustrich Co., which will continue the business at the present location, 472 Lafayette boulevard, Detroit.

Superior Body Corp., Rahway, N. J., has been incorporated with a capital stock of $500,000 by Joseph Oxman, Thomas and David Armstrong, to manufacture automobile and carriage bodies.

Clark & Kendrick, Inc., West 55th street, New York, manufacturer of automobile bodies, has leased the three-story building being erected at 126-134 West 50th street.

Ames Body Corp. has succeeded the Carriage Woodstock Co., Owensboro, Ky. Will E. Couty is secretary of the corporation which is capitalized at $500,000.

Miller Wagon Co., Calmar, Ia., has increased its capital by $100,000 to take care of the expansion in its wagon, motor truck body and cab production.

Watkins Commercial Body Corp., Buffalo, has awarded contract for the erection of a two-story factory, 31 x 150 ft., at Genesee and Monroe streets.

Ford Motor Co., Detroit, will erect a manufacturing plant for bodies and wheels at North Memphis, Tenn., according to rumor.

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A Car Curtain Receptacle

A nuisance yet a necessity—this describes the opinion of most motorists for the side curtains on their cars. Of great value when a storm overtakes the motorist on the road, the curtains become "de trop" or "in the way" when the weather clears. They are then jammed in some nook or corner about the car to keep them out of the way until another rain storm occasions their use. Various places are selected as a hiding place for them, none of which, however, are satisfactory.

One manufacturer, in order to remedy this condition, has put on the market a bag especially designed as a re-

ceptacle for side curtains when not in use. This bag is made of rubber cloth and is about 15 in. in length and 12 in. in width. It has a flap which buttons over the top, making it quite tight. The bag prevents the curtains from getting wet, dirty and mildewed. It is easily kept clean and is quite durable. It may be slipped under the seat where it is out of the way, but instantly ready for use when needed and where it will be perfectly safe.

Its use saves motor car owners many dollars in added life of the curtains and prevents the windows from becoming broken.

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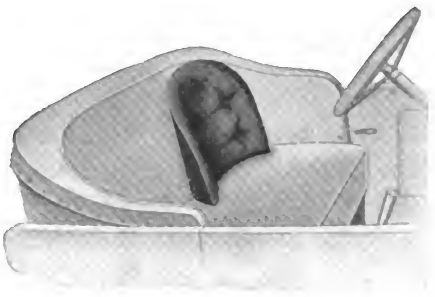
This back rest takes the bachkache out of long tours. Lady drivers and men of short stature will find it especially useful and necessary to them. The rest is of con-



cave, form-fitting shape and gives the driver perfect riding luxury. It adjusts itself to and supports the back so that the user finds it a great aid to comfort and ease.

The back rest is neat in appearance, does not mar the upholstering or look out of place in the car. It is covered with a leather substitute which renders it dirt, grease and stain proof. It is thoroughly cleanable and sanitary and will last as long as the car.

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BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

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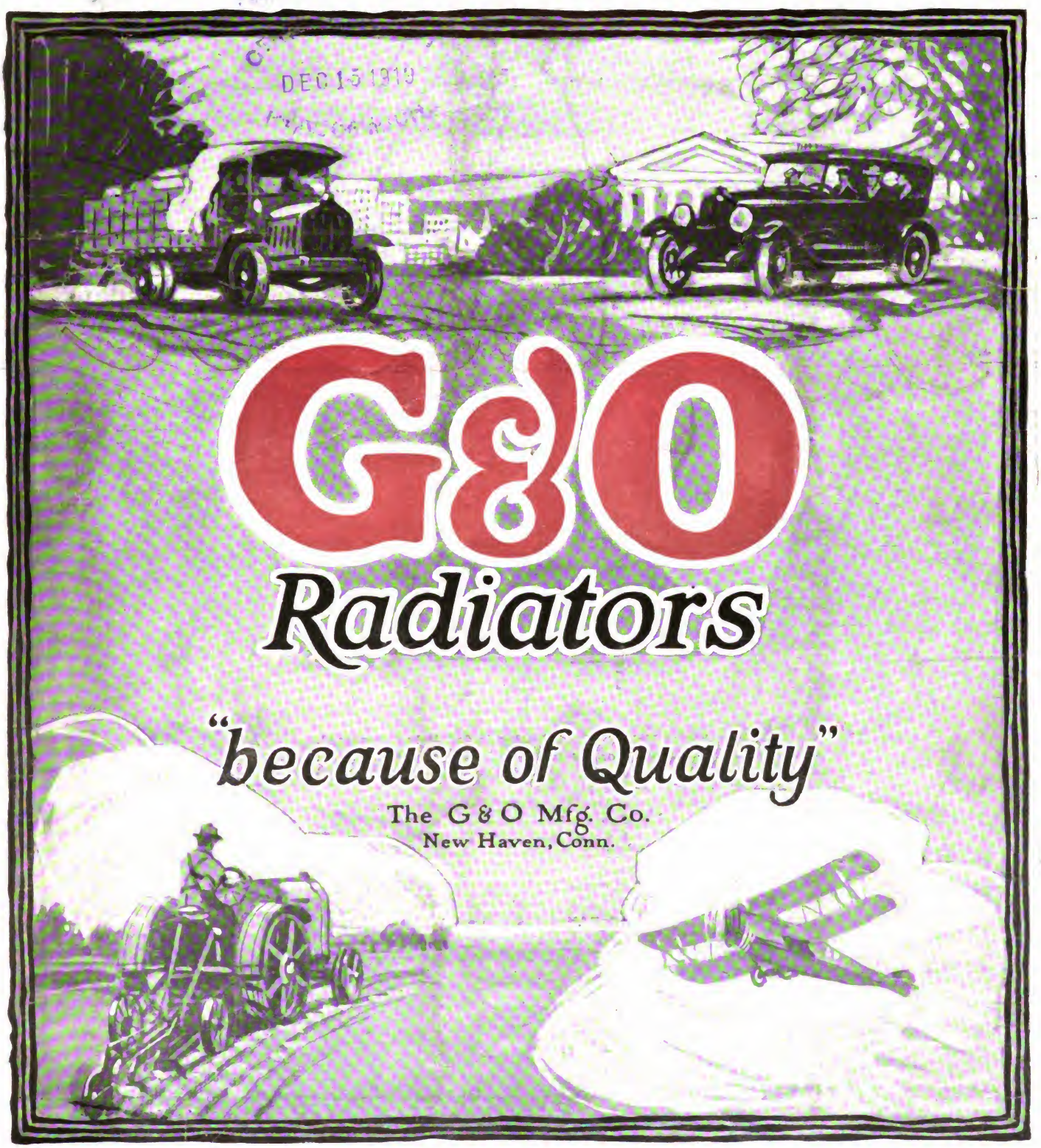

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The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXI NEW YORK, NOVEMBER, 1919 No. 8

World's Market Open for American Bodies

Present Shortage of Automobile Bodies Presents Big Opportunities for American Makers of Custom-made Forms as Well as Lower Priced Quantity Productions

IT will be admitted by the keen student of automotive affairs that the present world situation gives our American automobile, truck and tractor manufacturers the opportunity that they have often dreamed of but probably never expected to realize, namely, a chance to dominate the markets of the world. It might be stated this way, today the world is demanding American motor cars and will pay our prices and upon our terms. Within this is another opportunity, for the custom or superfine body makers of the country to obtain a strong hold in all other countries. The body makers of England, France, Belgium and other old-world countries are just as much behind the demands of those countries for fine bodies as their compatriots who are building cars are behind in their production.

Time was when the body styles of the world were made in Paris, and the creations of the best French body builders, as shown at the Paris automobile salon, set the pace for the world for that season. But as a parallel, it may be remembered that there was a time when France also supplied the world with cars. This is a thing of the past today, and despite renewed efforts on the part of French car manufacturers, many thousands of American cars will be imported into that country to fill its demands which the French makers can not do alone. More than just being able to make the cars, it is a fact that our cars are now sold in France (and other countries of Europe) in competition with the native product, are sold in spite of it so to speak, because they represent better value for the money expended.

Salamanca cabriolet in oyster white, a Brooks-Ostruk creation on a Rolls-Royce chassis

If this is so of our useful car, why should it not be true of our fine bodies? The answer is that our best body makers have never sought world trade, perhaps because no such opportunity as the present ever offered. Now that the opportunity does offer, it remains for them to take advantage of it, to follow it up with enthusiasm and aggressive action so that it does not slip away.

In this it should be remembered that the car de luxe is not always a quiet dignified creation; far from it in fact. Many people of means in Europe and especially in South America and the Far East when they want a motor car want something that is above all individual, and thus, different from the run of cars. This individuality may even take the part of extremely loud colors or something glaring or startling in the way of the body's shape or its accessories. But above all that, it must be exclusive and that means that it must be different from all others. From an American production standpoint this means that each job is different from every other one, so that costs will run up very high, but to offset that it should be remembered that the buyer of this type of car whether he be Pittsburgh millionaire or East Indian Rajah, is seldom

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concerned with the cost, the higher it is the better he considers the car and body to be.

Custom Body Has a Peculiar Charm

It must be admitted that the custom built body has a charm all its own, something which appeals particularly because it is different. This is the case with exporting fine bodies, if they are to appeal to the whims of European buyers they must be different. In the early days simple ownership of a motor car conferred a considerable distinction, and in many countries where the wealth is unevenly distributed and good roads are mostly a thing of the future, the same condition exists.

A case in point came up in New York recently. The owner of some mahogany land in Central America had result was a plan which included diamond studded clocks, burglar alarms, running water, phonograph, gold robe rails, and other idiosyncrasies. The body cost totaled $15,000 without the chassis, and the owner's only worry was that something had been overlooked.

Satisfying demands of this kind, springing from such sources as this very well suits the facilities of the European builder of prewar days, and in a good many instances his tastes also. With no particular aim or ability to reach volume production, what more direct or productive way to secure a great and growing revenue than by seeking recognition as a producer of vehicles not only approved by the royal and the rich, but also distinguished for versatility in creating new designs? Changing fashions, in fact, have been the very basis of the European builders' business heretofore.

This Paris-built limousine by Felber, on a Renault chassis, gives a means of comparing the imported work with the domestic

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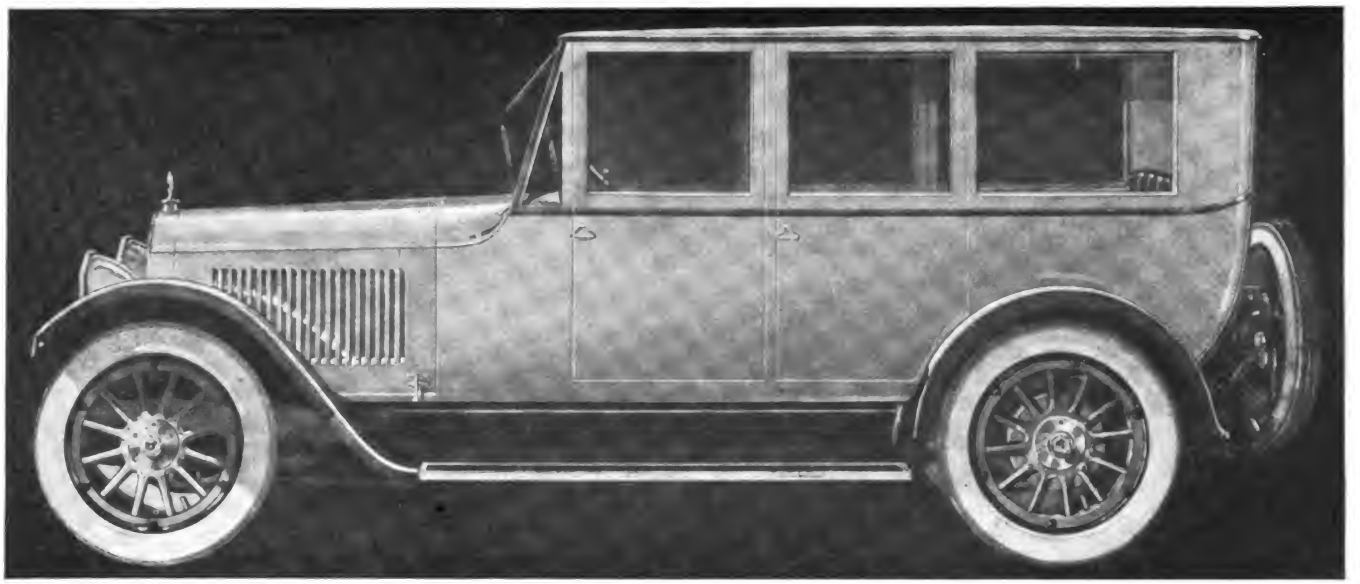


Berline body by Rubay, of Cleveland, on a Cole chassis. A roomy seven-passenger job. Note the special rain-proof windshield and extra wide doors

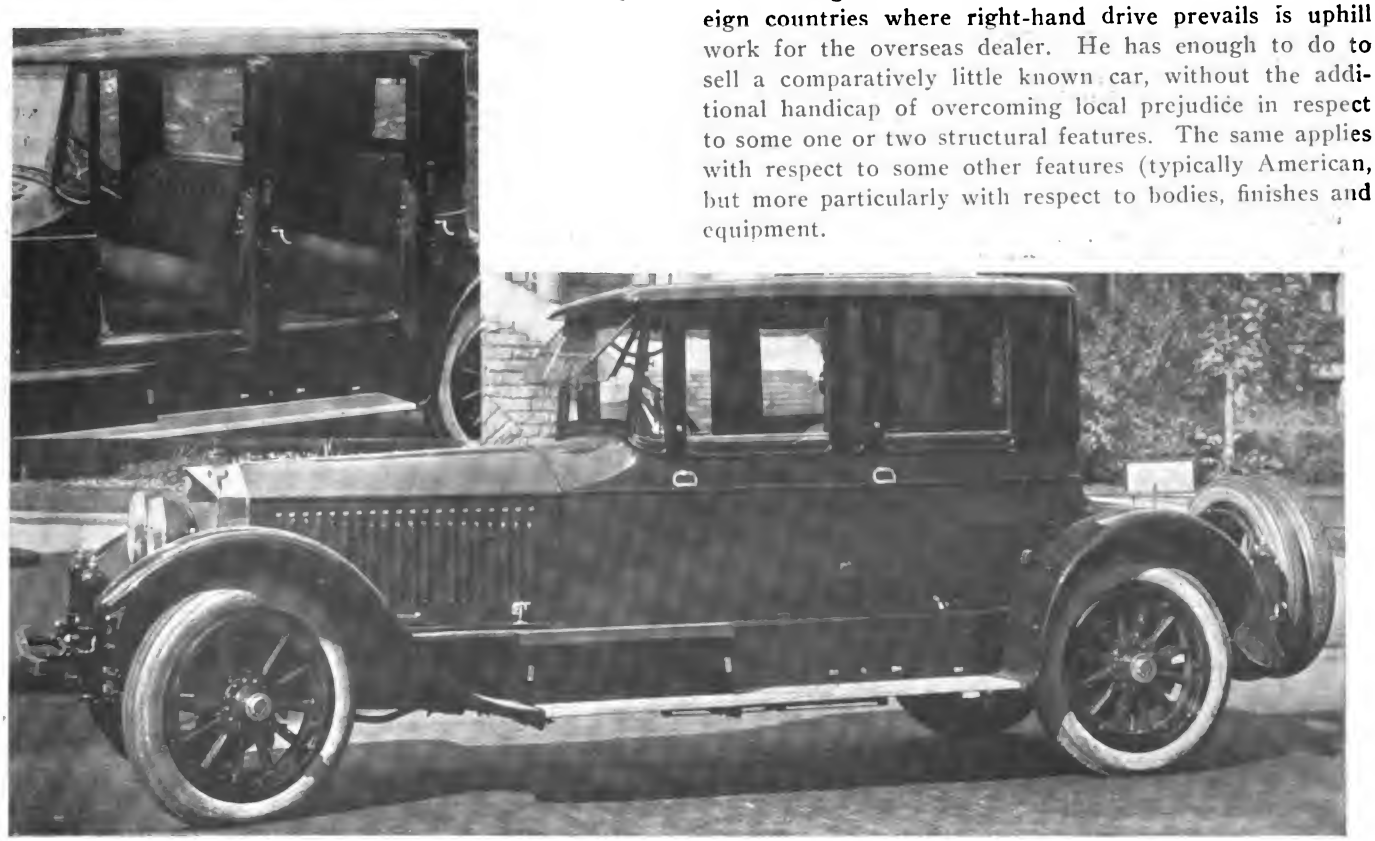
Quantity Rules American Production

By contrast, the position of the American manufacturer is diametrically opposite, and always has been. Here quantity has ruled, as the only means of keeping down the price, while low and ever lower prices have been recognized as the only feasible means of marketing production enough to keep the perpetually growing plants busy. This, of course, governs the American producer's view of his home market only, but also, it largely circumscribes his attitude toward foreign trade.

American cars are fitted for foreign competition in many ways, not only in matter of price, but likewise in respect to ease of handling, freedom from gear changing, ability to negotiate execrable roads and withstand all manner of punishment at the hands of unsympathetic drivers, and finally in durability under adverse circumstances. American cars are unfitted for foreign competition; first insofar as American standards of construction clash with foreign standards, respecting, for instance, the question of right- or left-hand steering position; and second, insofar as American business methods lack adaptability to business requirements abroad.

Left-Hand Drive Not a Big Handicap

Marketing American cars having left-hand drive in foreign countries where right-hand drive prevails is uphill work for the overseas dealer. He has enough to do to sell a comparatively little known car, without the additional handicap of overcoming local prejudice in respect to some one or two structural features. The same applies with respect to some other features (typically American, but more particularly with respect to bodies, finishes and equipment.



An American built four-door sedan elite on an Owen-Magnetic long wheelbase chassis. This Brooks-Ostruk job was painted maroon and trimmed in maroon broadcloth

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Bearing in mind that distinctive style appeal is still the basis of demand in countries where even the lowest priced American cars are luxuries for the majority of buyers, it can be readily understood that cars, however appealing or distinctive in the type, quickly go stale when offered in multiple. In countries where the equivalent purchasing power of the dollar is even greater than it is in this country, it must be remembered that products listing here for $1,000 may be sold for upwards of $2,000, while cars in the $2,000 class here, rank there among the more rare and exclusive possessions. Similarly the South African purchaser of an American $3,000 car probably could afford a much more expensive car should he choose to select one.

Hence, when the overseas agent for an American car, however appealing in other respects, is compelled to hold his trade down to stock products he suffers a certain amount of hardship. The customer in many cases likes the car in all respects save the single one that it exactly resembles all other cars of the same make and model. That helps in the sale of the first few cars, but hampers subsequent sales.

Not Advisable to Split the Job

A solution offered in many cases by enterprising overseas agents is for the American builder to ship chassis only. This saves freight, but loads the purchaser with the cost of a locally built body, besides depriving the manufacturer of his profit on the body. It also permits to escape from American industry both the income and the experience to be derived from catering to foreign demand, and so paving the way for the business of the future.

Another device is to have the complete car and body repainted and reequipped locally, where such embellishment will satisfy the local customer's needs. This, however, is not wholly satisfactory, while the alternative of ordering special painting and equipment from the factory in most cases has proved to involve more trouble and less satisfaction than either producer, buyer or customer can put up with after the first few trials.

Notwithstanding these difficulties the fact remains that it is a mistake to permit the special requirements of the particular buyer to pass unrecognized in foreign trade. It is an error to permit the impression to go abroad that the American industry is incapable of building fine and distinguished appearing cars except in series, and it is economically wrong to permit a portion of the income from foreign business to pass to foreign hands, even though to a degree controlled by representatives of American industry.

Foreign Demands Not Widely Different From Domestic

It is particularly shortsighted policy entirely to ignore the peculiarities of foreign demand in view of the fact that such peculiarities—so far as the bulk of the business is concerned—are largely temporary and associated with the introductory phases of the business. The exclusive demand is, in other words, in part a phase of the budding market. There was a time when American demand evidenced the same tendencies. In fact, even today a rather large slice of domestic business is handled by dealers who supply special bodies and equipment to particular customers. These, however, are precisely the same classes of customers, economically speaking, who constitute the style-demand class in foreign markets—that is to say, the very rich and the very recently affluent, and also those whose position economically is a little better than that of a majority of their class.

With time, there is no manner of doubt quantity demand will arise in those very foreign markets that are today largely limited by specific demand. When that day comes price will more largely rule, and so the vogue of the American stock car, pure and simple, will mature, as it has here, and as it has in other countries where automobiles are really popular. To meet that opportunity properly, however, there must now be laid a foundation of respect and vogue for the American chassis and the American body—reckoning the two, for the moment, as distinct and separate. Such a foundation cannot be laid by policies of evasion, by declining such fragmentary opportunities as present themselves, or by seeking to force the purely stock car to fulfill a position in the budding markets of the world for which it is not naturally constituted.

Certainly the situation of the average manufacturer does not permit him, with his plant far behind orders for domestic consumption, to establish branch factories, or even departments capable of fulfilling the peculiar and often trying wants of the overseas buyers as voiced by their agents and his. There is no percentage in deviating from the course of multiple production, so far as the program of the average factory producing the better grade is concerned. Certainly the quantity producer is limited to his quantity models.

American Resources Unlimited

On the other hand, the American body builder stands ready to accomplish wonders in the way of development, and seemingly lacks only the initial impulse to rise to a production basis that is high for him, but that is yet well within the range of an individualized product and also within the range of that personal supervision of details that alone distinguishes the "refined" car from the stock product. It lies well within the possibilities for the American body maker to reach out across the seas and develop a fine line of business that shall be useful in no less than three distinct ways: It will expand his business far beyond its natural domestic limitations; it will solve the difficulties of the overseas agent and it will help to establish the American car among the particular clientele in foreign countries that demands an exclusive product and will take nothing else.

In a broad sense the economic status of the average custom body builder in this country warrants such a development more liberally than might be supposed. The background of the majority of such establishments is the small carriage or wagon shop of the old days. Its artistry and its traditions are those of the time when carriages were built, rather than produced, and the best of the surviving organizations are those which formerly catered to an exclusive clientele. They, therefore, best understand the requirements involved in dealing with the whims and fancies of particular customers.

Old Carriage Builders Best Bodyworkers

These firms have turned naturally into coachwork and by their trait of sticking to the one line of work have risen from the common run of old time businesses and have mastered the knack of translating the deft touch which made the old time carriages the works of art which they undoubtedly were, into the more refined automobile bodies of today. Their great stumbling block has been and still is, and in all probability will be for some time to

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come, the fact that originals, that is absolute originals, are extremely costly, more so, perhaps, than even the average run of special body buyers are willing to pay for. To create an entirely new and distinct body will in every case cost more than the chassis upon which it is to be placed. The natural tendency—stopped temporarily by the war—is for chassis and ordinary car prices to come down each year.

In this way our more successful body builders have established their reputations, each one having its own styles which were peculiar to it, its house style, so to speak, by which it is known. Thus a firm more or less known as a limousine house would confine itself somewhat closely to that form of enclosed body and would develop superior ideas and styles in limousine lines, details and equipment.

Obviously such a policy could not be carried to an extreme of quantity production, as that would destroy the value of the specialization and take away the idea of exclusiveness and originality which is the basis for all custom body work. But such specialization, modified to the extent of incorporating in each job the special whims or individual tastes of the buyer, would go a very long way toward solving the body builder's problem, for it would enable the production of a custom-made body creation which was different, and thus, exclusive so it met the needs and desires of the buyer, and also could be sold at a reasonable figure and still yield the body builder a handsome profit.

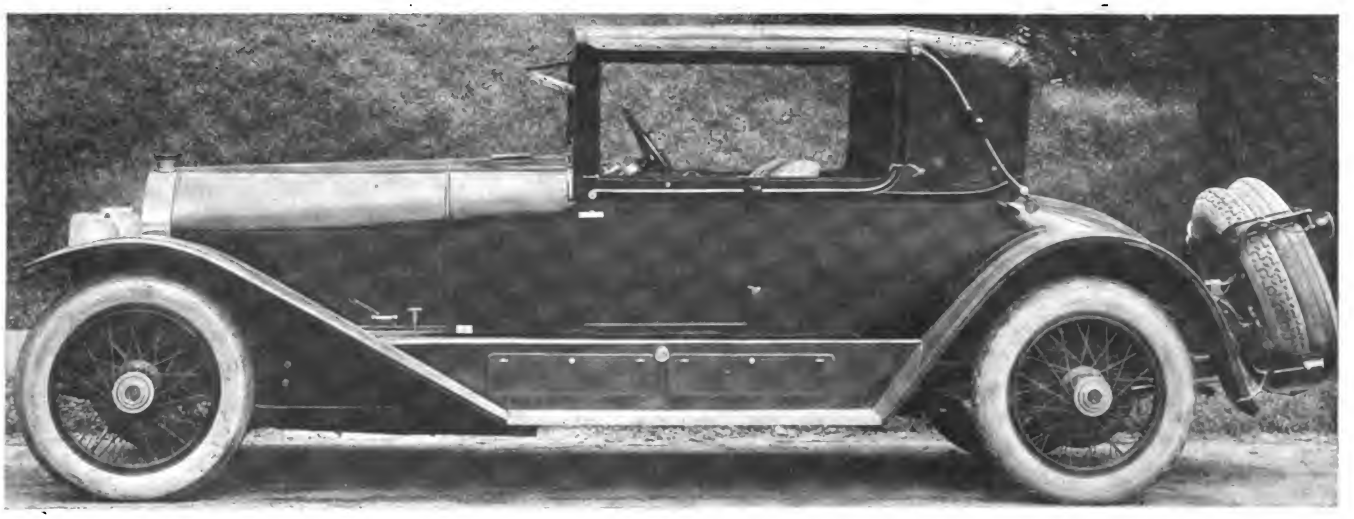
Referring back to the matter of foreign trade in bodies, such a plan ought to work out in an ideal way, for it would permit of producing practically the same body for the Argentinian cattle magnate and the Indian Rajah as for the war millionaire in this country, but with the individual modifications of each of the three embodied in it.

This, then, is the situation. The bodymakers possess in high degree the ability to meet the requirements of the foreign buyer, some of them having already had more or less experience along this line. As explained, the foreign buyer needs the special body job, and especially the car that is more or less "dolled up" to suit his fancy, and he it at present unable to secure it in Europe. The American manufacturer, on the other hand, is making about his greatest possible concession in setting aside for export a percentage of his present lagging production—possibly with right-hand drive and one or two other special details, but absolutely based on standard lines. The foreign wholesale buyer and the foreign representative of the manufacturer, to bring still another factor into view, are struggling to get through a percentage of the total volume of cars they require, and are glad enough to get stock products; special jobs for the most part being out of the question. The thing is more or less unsatisfactory all around.

In the face of this situation is it not apparent that through these same factory representatives and buyers, or through foreign banks, export houses and foreign business corporations it should be able to open a partial outlet for special bodies on chassis purchased in the open market here? And is it not apparent that under proper encouragement this will be done, to whatever extent there is profit in the business?

To revert to the matter of Paris leadership in fine body work, in all fairness it must be admitted that many of the best French ideas have been used in a small way in this country previously. Thus, the straight lines which are the vogue in France this year have always been used by Packard, for many years by Murray and Roamer, as well as by a number of other firms. The absence of side lamps is an Americanism of 1916, as is also the complete instrument board upon which all instruments are grouped before the driver. The attempt to eliminate the radiator cap was tried in this country by several makers three and four years ago. The boat type of sporting body was thoroughly tried out here five years ago and again four years ago, very slight traces of this influence remaining to date. That is, when Paris goes in strong for the boat body this year, makers there are simply inviting the lack of success which attended the introduction of this body in this country some years ago. So, too, in the matter of miniature doors in other sporting type open cars, in the more extensive use of caning, in the deeper body panels and smaller window lights, in the clean running boards, more complete fenders, and other ideas, Paris is not originating, but on the contrary is following.

To sum the matter up, the world today needs and invites not alone American motor cars, but American-made custom bodies as well. Will our body builders of the best class respond to this wonderful opportunity—which in all probability will never offer again? We believe they will.



Long, low lines characterize this special gunboat cabriolet on Loco mobile chassis. Compare its height (6 ft.) with ideal touring car on page 10, October Issue

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The Design of Airplane Engines---VI

By JOHN WALLACE

Elementary Principles, Torque, Balance and Secondary Forces, the Commonly Used Types and Sizes, and Advantages of Each

(Continued from page 168, Automotive Engineering, April)

IF THE cranks are set at 180 deg. apart (in the side-by-side twin), the period between consecutive explosions is not constant, but is ultimately 540 deg. and 180 deg.; although the ratio of maximum/mean torque remains the same in each case, viz., about 4 to 1. It will be readily apparent that with the cranks 180 deg. apart the primary inertia forces of the two sets of reciprocating parts are in balance although the secondary forces (which it should be remembered are of twice the frequency of the primary forces) remain unbalanced. Moreover the total inertia forces of each set of reciprocating parts being different at all points in the stroke, it follows that there will result a strong couple tending to make the whole engine oscillate in the plane of the cylinders.

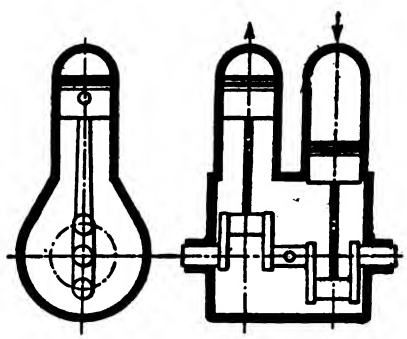

Fig. 32—Layout of the two-cylinder engine with two cranks

This tilting couple is illustrated in Fig. 32, which depicts the case of a side-by-side twin (of the same dimensions as the 160 h.p. Mercedes) when the pistons are at the end of their strokes.

It does not require any further explanation to show that mechanically the side-by-side twin engine is an unsound proposition, and added to this are other disabilities which render the type unsuitable for use in aircraft. It is essentially a heavy class of engine, and if placed with the crankshaft axis in the line of flight can not be effectively air cooled owing to the reasons explained in Part II of this series.

Twin-Cylinder Vee Engine

Engines with two cylinders disposed in the form of a Vee have for years past been extensively employed in driving motorcycles. In engines used for this purpose the angle between the cylinders varies between 35 and 60 deg. The two connecting rods are arranged to work upon a single crankpin. The balance of such engines is a little better than that of a single-cylinder and the torque is considerably improved. The best arrangement, however, is obtained by placing the cylinders 90 deg. apart, as shown in Fig. 33, when the primary inertia forces may be completely balanced by the aid of a counterbalance on the crankshaft. Upon investigation it will be found that the resultant of the primary inertia forces acting in the two cylinders at any point in the stroke is a constant radial force acting along the crank arm and of a magnitude equal to the maximum primary inertia force in one cylinder. The resultant of the secondary intertia force in a 90 deg. V twin always acts along a transverse horizontal plane through the intersection of the cylinder axes, e. g., the crankshaft axis, and passes through zero four times during every revolution. The maximum unbalanced secondary force occurs every time the crank lies parallel to the axis of either cylinder and is equal to $\sqrt{2}(Fy)^2$ where Fy is the maximum secondary force occurring in one cylinder. In the case of a 90 deg. V twin of the same cylinder dimensions as the 160 h.p. Mercedes and running at 1,400 r.p.m., there exists a maximum unbalanced secondary force of $\sqrt{2}(406)^2 = 575$ lbs., tending to displace the engine in a horizontal transverse plane.

The ratio of maximum/mean torque is substantially the same as in the side-by-side twin, viz., 4 to 1, although the angular period between successive explosions is alternately 450 and 270 deg.

The Horizontally Opposed Twin

From a purely mechanical point of view the horizontal opposed engine is the finest type, but owing to the unwieldy shape of a high powered engine of this class it has not been employed in modern aircraft. However, for the small sporting machine of the future it should prove ideal. Not only can it be built of very light weight, but it is cheap to manufacture and may be perfectly balanced. Referring to Figs. 34 and 35, it will be seen that the two cranks are spaced 180 deg. apart so that the instantaneous velocities of the two pistons are always equal, which means that the inertia forces (both primary and secondary) are always in perfect balance. In many horizontally opposed twins the axes of the cylinders have been staggered as in Fig. 34, giving rise to an unbalanced couple about the point A. Moreover in such an engine the crankshaft itself is not truly balanced owing to the distance between crank throws. By employing a three-throw crank and a compound connecting rod for one of the cylinders as indicated in Fig. 35, perfect balance of the whole of the moving parts may be obtained. This is, of course, only on condition that the weights of the reciprocating parts are the same in each cylinder and every effort should be made to secure this condition. It can only be achieved with certainty by machining the whole of these parts, but further reference to this matter is postponed until we come to treat of the design of pistons and connecting rods.

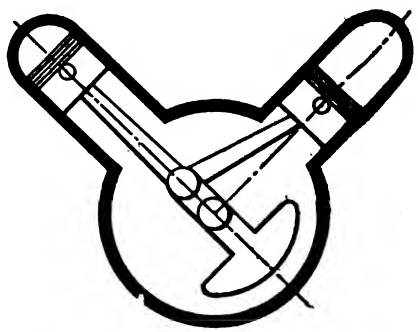

Fig. 33—The two-cylinder V motor with balance weight

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Three-cylinder Engine

Apart from the well known fixed radial Anzani engines, motors of three cylinders have not been used as power plants for airplanes. The three-cylinder vertical engine possesses some peculiar features in the matter of balance which will now be explained, and it is chiefly due to these that the type is unsuitable for aircraft. If the necessary calculations be made it will be found that both the primary and seecondary inertia forces are in balance, but the total inertia force in the two end cylinders A and C in Fig. 36 being different, there is a large tilting couple about the center of gravity of the engine. In the accompanying illustration the engine is shown with the piston in cylinder A at the top of its stroke; at this instant the total inertia forces in pounds acting in the cylinders A, B, and C respectively are + 1,866, — 933, and — 933. Therefore the maximum tilting couple about the point O is equal to 1½ times the maximum inertia forces in one cylinder multiplied by the distance between the axes of adjacent cylinders. In the present case—a three-cylinder engine of cylinder dimensions similar to the 160 h.p. Mercedes—this couple is 1.5 x 1,866 x 8.1 = 22,672 inch-pounds acting in a vertical plane. Moreover, unless each crankpin is individually balanced together with the rotating mass of the connecting rod, by counterweights upon the crankarms, the centrifugal forces of these parts will induce a very considerable couple acting in a horizontal plane. From this it will easily be understood that a three-cylinder vertical engine of ordinary design is subject to both tilting and slewing couples of comparatively great magnitude.

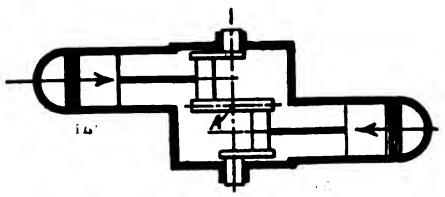

Fig. 34—Opposed two-cylinder motor with two cranks

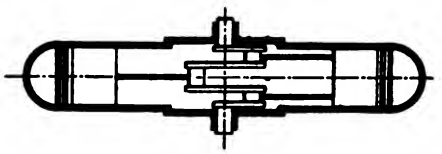

Fig. 35—Opposed two-cylinder with three cranks and rods

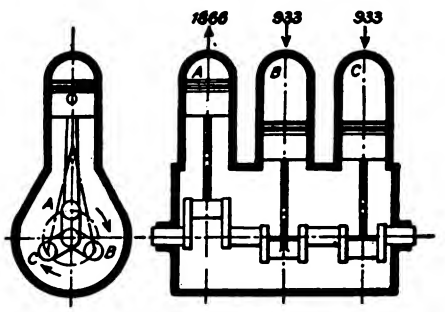

Fig. 36—Layout of three-cylinder vertical motor with three cranks

Three-cylinder vertical engines of the two-stroke cycle type are widely used for marine work, and in this case it is usual to employ balanced crankshafts. The torque of the three-cylinder vertical when working upon the four-stroke cycle is fairly regular, the ratio of maximum/mean torque being in the neighborhood of 2.9 to 1.

Four-cylinder Vertical

In the early days of aviation when low horsepowers were the rule, engines of the four-cylinder vertical type were not infrequently installed, and there are reasons for expecting a revival of the type in post-war designs. Being cheap to manufacture with its balance and torque decidedly good, this class of engines has proved extremely popular as the propelling agent for motor cars.

A four-cylinder engine with the conventional arrangement of cranks is illustrated in Fig. 37. It will be seen that the pistons in cylinders 2 and 3 reciprocate in unison and in simultaneously opposite directions to pistons 1 and 4. Owing to the instantaneous velocities of the inner and outer pairs of pistons being different at all points in the stroke, only the primary inertia forces are in balance. As the several cranks all lie in the same plane it follows that the secondary inertia forces of the four sets of reciprocating parts synchronize, and therefore are not in balance. The maximum unbalanced force occurs four times during each revolution of the crankshaft and is equal in magnitude to four times the maximum secondary inertia force of the reciprocating parts in one cylinder. This unbalanced force always acts in a vertical direction and does not give rise to any tilting couple.

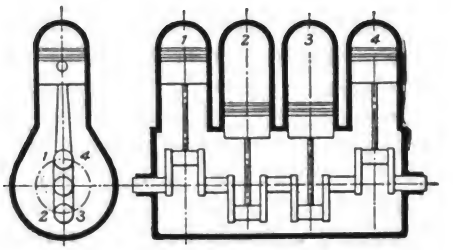

Fig. 37—Typical four-cylinder vertical engine, four cranks in one plane

There being two expansion strokes during every revolution the torque is always positive; the ratio of maximum/mean torque is about 2 to 1.

The Six-cylinder Vertical

The balance of the vertical six-cylinder engine is to all intents and purposes perfect. It will be seen from Fig. 38 that the cranks are spaced 120 deg. apart, as in the three-cylinder vertical, cranks 1 and 6, 2 and 5, and 3 and 4 being arranged in pairs. Not only are the primary and secondary inertia forces in perfect balance but the tilting couple of the first three sets of reciprocating parts is balanced by the couple due to the other three. This causes considerable loads upon the center crankshaft bearing and it is necessary to ensure the utmost rigidity of the crankcase if trouble due to this cause is to be avoided. The ratio of maximum/mean torque in the six-cylinder vertical is 1.45 to 1.

Eight-cylinder Vee Engine

The advantages obtained by mounting two batteries of cylinders upon a single crankcase and in the form of a Vee were outlined in Part 1 of this series. Eight-cylinder Vee engines with the cylinder batteries disposed at an angle of 90 deg. have been extensively employed in aircraft.

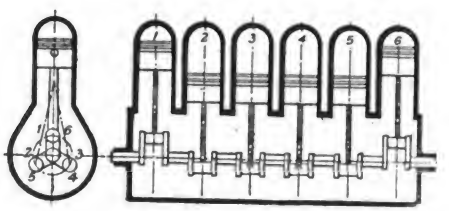

Fig. 38—Usual six-cylinder motor, six cranks in three planes

For the purpose of investigating the degree of balance, the eight-cylinder 90 deg. Vee type may be regarded as consisting of four 90 deg. Vee twins with the four crank throws arranged in the same manner as in a four-cylinder vertical. The cranks 2 and 3 being 180 deg. from cranks 1 and 2, it follows that the resultant of the primary inertia forces in the two end pairs of cylinders in the eight is balanced by the resultant of the primary forces in the

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inside pairs. As in the 90 deg. twin the secondary forces in an eight-cylinder 90 deg. Vee are out of balance, and combine to cause a transverse horizontal unbalanced resultant acting through the crankshaft axis. Obviously the magnitude of the maximum unbalanced force is equal to four times that occurring in a 90 deg. twin of the same cylinder dimensions. Expressed as a formula, the maximum unbalanced force in an eight-cylinder 90 deg. Vee engine is equal to $4\sqrt{2}(Fy^2)$ where Fy is the maximum secondary inertia force acting in one cylinder.

Twelve-cylinder Vee Engine

The usual angle between the two batteries in twelve-cylinder engines is 60 deg., but in view of the fact that both the primary and secondary inertia forces in each battery of six cylinders are in perfect balance, it is possible to reduce this angle, as in the Liberty engine, without impairing the balance of the engine.

The balance of the reciprocating parts is perfect in any twelve-cylinder Vee, and this fact together with the practically constant torque obtainable, serve to make this type of engine admirably suited to installation in airplanes. Owing to the great overall length of such engines the use of balanced crankshaft is almost essential. It should be pointed out that the central main crankshaft bearing is subjected to great loads in the same way as in the six-cylinder, and for this reason every efort should be made to keep the length of the engine as short as possible, and the engine must be rigidly supported in the nacelli.

(To be continued)

Germans Impressed by Liberty Motor

Near the end of hostilities last year the British bomber Hyderabad No. 3, built by the Westland Aircraft Works, fell into German hands. The engine, which was a Packard-built Liberty 12, of the standard army type, was apparently uninjured, and gave the German engineers full opportunity to investigate its construction and performance ability. There is no doubt but that the German engineers were most favorably impressed with the design and performance of the engine.

Their tests confirmed practically along the whole line the results of similar tests, made for example at McCook field by the Aircraft Engineering Department of the War Department. In fact, the only serious criticism made by the German engineers is that a motor of such tremendous power direct propeller drive was used. This, however, is a matter about which aircraft engineers the world over disagree, and our own engineers were not in agreement on that matter, some holding for a slightly lower engine speed and direct drive, as the Liberty engine was built, and other favoring higher engine speeds and geared down propellers.

New Fuel Adopted by Air Mail Service

A new motor fuel, consisting of alcohol, benzol and ether is being tried out by the air mail service and is expected to become the regular fuel in this service in place of high test gasoline. This fuel keeps the engine cleaner as it burns up more completely. Further it reduces the cost of upkeep and burns cooler than gasoline. The latter overcomes the objection to high compression engines when operated at low altitudes. For any given distance and altitude, only about four-fifths of much of the new fuel is needed. Besides reducing the probability of forced landings through dirty spark plugs, it increases the flying radius to such an extent that the DeHaviland Fours will be able with it to make Cleveland from New York in a single non-stop flight.

British Passenger Airships

The Northern Aerial Syndicate is said to be arranging a passenger airship service to the United States. The plans are for airships carrying 150 passengers, in addition to staffs of cooks, stewards and crew, to serve the westward and eastward passages between England and New York. Perth, Australia, will also be served, seven days being allowed for this journey. At Liverpool passengers from America will be transfererd to smaller aircraft and taken to their destination. Moorings will be provided at leading hotels.

S. A. E. Annual Meeting Program

The annual meeting of the Society of Automotive Engineers will be held in New York January 6, 7 and 8, 1920. Besides the usual committee reports and the various luncheons, dinner and other social functions, technical papers on these subjects will be read and discussed:

Symposium on Needs and Tendencies in Engine Design, F. H. Trego (other authors to be announced later); Aluminum Pistons, E. G. Gunn; Automotive Steam System, L. L. Scott; Automobile Body Design, author to be announced; Spring Suspension for Passenger Cars, Benjamin Liebowitz and possibly other authors; Adapting Engines to Use of Available Fuels, J. G. Vincent; High Speed Indicators, P. S. Tice and Thomas Midgley, Jr. (will probably be accompanied by demonstration of indicators in actual operation on an engine); Lubrication Research, author to be announced; Symposium on Combustion of Hydrocarbon Fuels, authors to be announced); Fuel Mixtures, author to be announced; Bettering Efficiency of Existing Engines, H. C. Gibson; Carburetion, Prof. C. C. Berry; Supercharging Engines, Major George E. A. Hallett; Notes on Impact Testing, J. H. Nelson; Thermodynamics of Carburetion, C. F. Hopewell.

Important English and French Motor Firms Merge

An important merger was consummated in England recently when the Darracq Co., one of the oldest firms in the British motor industry with two large factories in France and one in Fulham, London, and the Clement-Talbot Co., were consolidated. For the present there will be no changes in personnel or design, but a new eight-cylinder called Talbot-Darracq is being shown at Olympia.

New Source of Rubber in Dominican Republic

The restriction of rubber shipments from the Far East has produced an earnest search for sources of rubber nearer to New York. Besides serving to exploit the Mexican guayule shrub, this situation has brought to light a tree in the Dominican republic which yields rubber. This is found in a wild state through the zone of Sanama, Sanchez, and a large part of the Cordillera del Seybo. It is known as the balata (Mimusops balata). of the family of Sapotaceae, and yields a good latex which serves as a substitute for gutta percha.

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Improved Quality the Feature of Cars at Paris Salon

Review of First Big International Post-War Automobile Show Indicates Many Big Changes in General Tendencies Abroad, and in Details of Construction

WHEN the fifteenth salon opened in Paris recently with the first of the big international displays since the beginning of the war, it revealed not alone a larger number of manufacturers than any show held before the war, but also a larger number of new concerns than the salon has ever had. Moreover, the cars showed a newness, a freshness of design, which probably has resulted from the war changing many former viewpoints, as well as from its influence upon production methods and results.

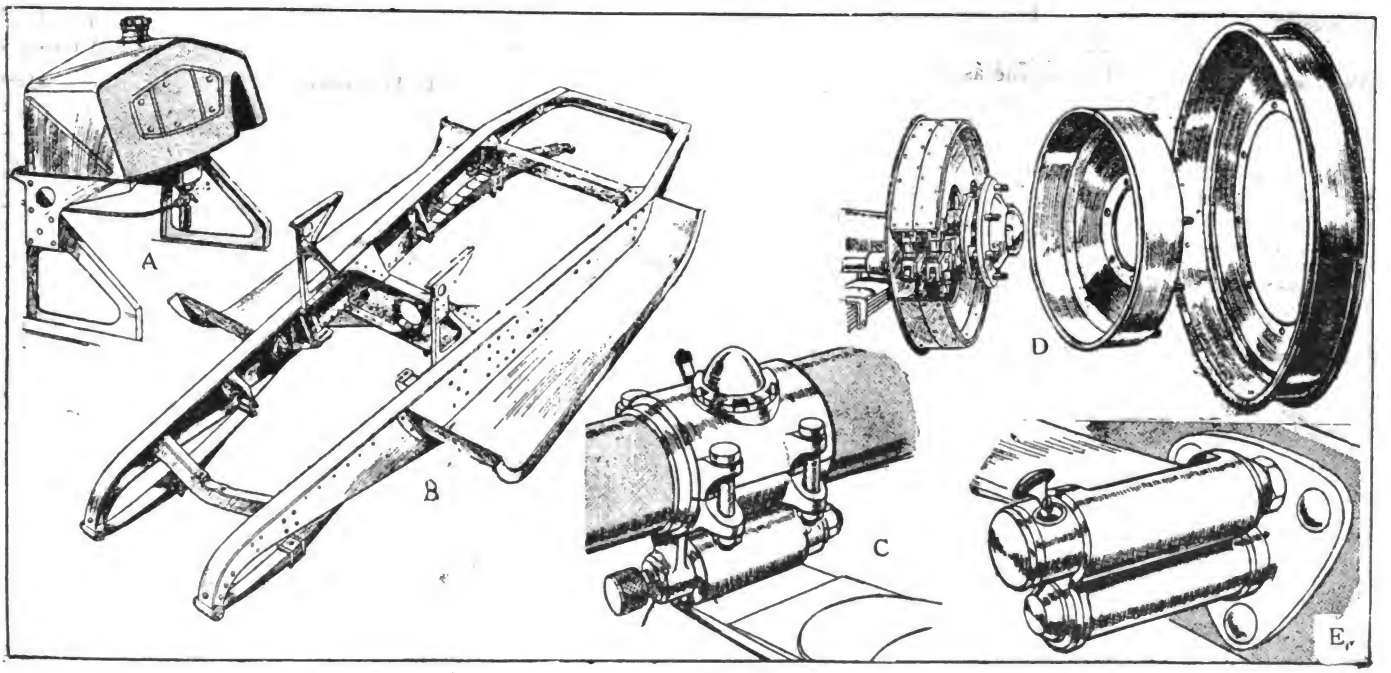
A detailed examination of the cars and chassis indicated that the two outstanding points in French motor car construction during 1919-1920 will be the markedly improved quality, which is shown throughout the design and construction, and for the first time in French motor car history, a decided increase in quantity.

As a result of the war work which practically all automotive plants throughout the world have been doing for several years, the use of better materials, better workmanship and much better manufacturing methods have been learned. The two former have produced the better quality of the cars and the latter is expected to give the greater quantity. In this respect American methods, shop layouts and equipment have been acquired freely and largely, with the result that for the first time a number of French concerns refer to their output in cars per week. Thus Citroen is trying to reach a production of 100 cars a day and Renault is going after 50. Before the war the former built no motor cars and the latter turned out about the same number per month.

As might be expected the improvement of quality has been reflected in the unusually large number of makers producing cars of the highest price and nothing else. That is the greatly improved quality of the product has taken all of the old familiar names out of the small cheap and medium price classes and grouped them in the high priced class. Those makers of very high quality cars before are now turning out a product which is almost beyond price from a prewar standpoint. As an English observer aptly put it, the show had altogether too many cars in the £1,500-£1,800 ($7,500-$9,000) class and all too few in the £300-£500 ($1,500 to $2,500) class.

While it must be admitted that incomes all over the world have gone up, it is difficult to see that they have gone up sufficiently to absorb a much larger car output than before the war at a price which is from 60 to 75 per cent higher for the high quality cars, and in addition a tremendous output of medium and low priced cars, also at greatly increased prices as compared with prewar car prices which were considered low or medium. In short, it seems the supercar has been overdone, both as to number of makers and total output of each one.

From this it should not be thought that the small and medium priced cars are lacking, for such is not the case. They are well represented, but mainly by new firms, newcomers in the motor car field, as for instance Citroen, the gear maker previously mentioned. These new firms showed in the small, well designed machines of 12-16 h.p., monobloc four-cylinder motor, designed for extreme economy of performance, and by comparison with prewar jobs, also showing a marked increase in fine workmanship, and better materials. The price of the majority of these is doubtful, the makers themselves being in doubt as to what figure



Some frame and chassis details seen at the Paris Salon. A—Cowl tank support on Armstrong-Siddeley. B—Armstrong-Siddeley frame. C—New Farman trunnion support for cantilever spring end. D—Detachable disc wheels on Armstrong-Siddeley, of which brake drum forms the center. E—Panhard hollow spring shackle bolts are filled with oil through covered hole.

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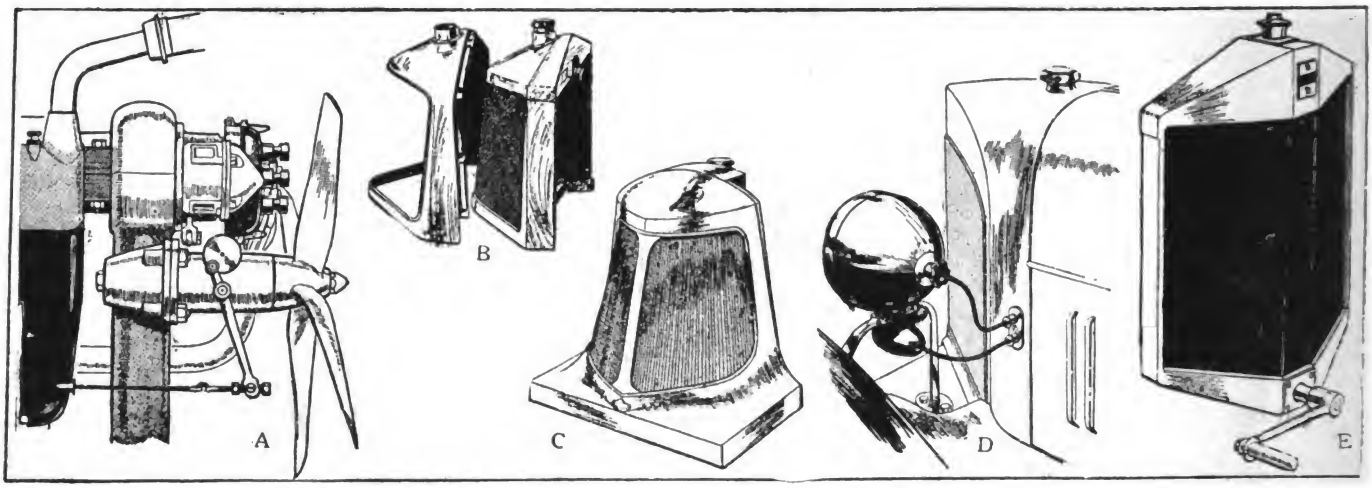


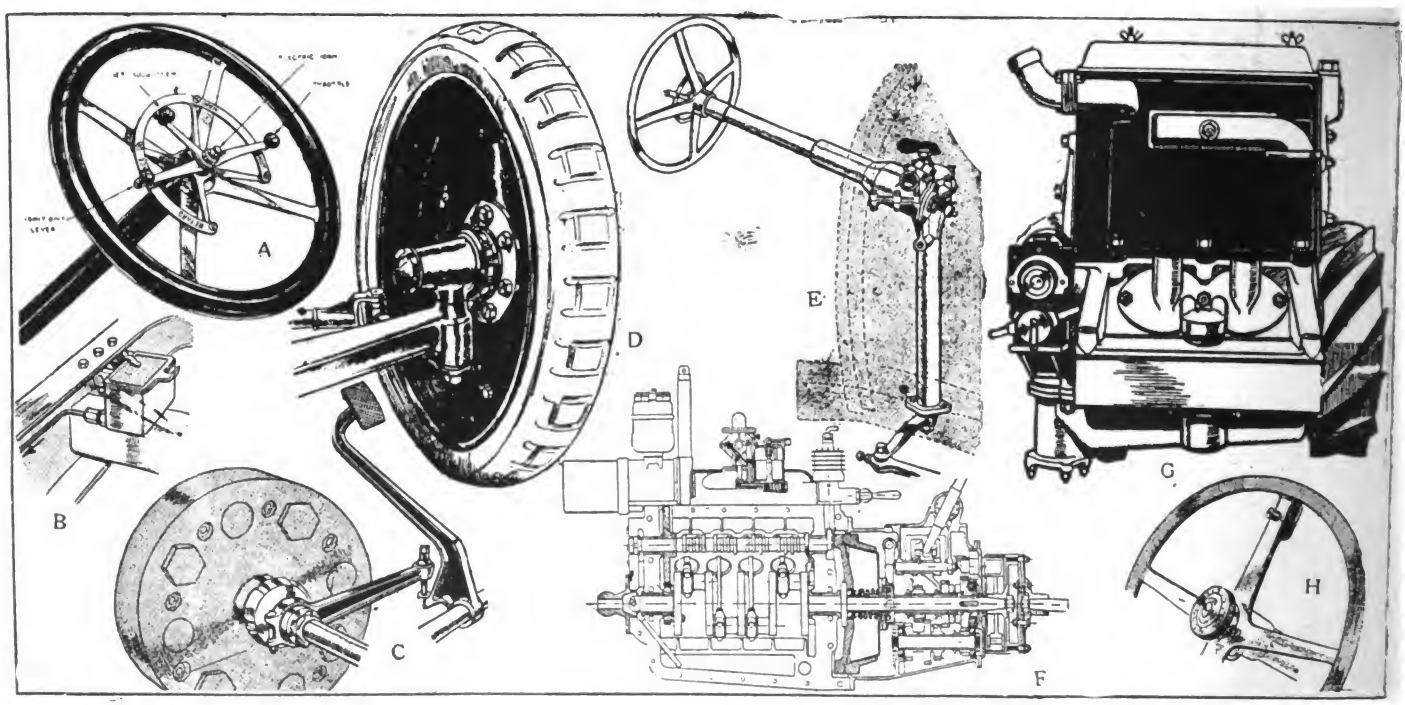
Some radiator and cooling system novelties at Paris. A—Farman makes provision to throw cooling fan in and out of action. E—A separate outer sheath covers all but the tubes on Armstrong V front radiator. C—Alda radiator has a concealed filling cap. D—New model Fiats use the V-type radiator. E—Sizaire-Berwick has gone to V radiator with a slight flat spot.

should be set, and even when it is set, making it subject to frequent upward revisions. Thus, Citroen announced his light car last spring to sell around $1,500, but this price has been revised to $1,800, with a possibility of going to $2,000 soon.

Another Americanism is noted in the universal adoption of electric lighting and starting. Judging from the show details, all French machines this year, even the cheapest, will have starting and lighting outfits as an integral part of the power unit.

In body forms, the most marked tendency is toward enclosed bodies of one type or another. While the French have always been partial to the enclosed body, it has been taken up this year to an extent which makes it almost universal. In the matter of body lines it might almost be said that the French and Continental builders have abandoned curved lined and body curves. The straight line effect predominates to a remarkable extent, this resulting in square or sharp corners where formerly curves were used.

There are no single or two-cylinder motors, the block four being used in all small cars. In the better machines the six is strongly predominating, while there are a few eights, most of them V's but a few all-in-line. The show uncovered only one twelve, although two prominent makers are rumored as converts to this form. There were two outstanding motors, both V types, one the Lancia twelve and the other the Suere eight. The unusual point about the former is that the twelve cylinders which are set at the small angle of 22 deg. are cast in a single block and have a common water jacket. The result is a remarkably simple appearing engine. The Suere V-type eight was notable for its small size, having a bore of but 45 mm. (1.77 in.). As a matter of fact the general run of cylinder sizes was very small, some 25 motors, including fours,



Additional motor and chassis novelties. A—Three finger levers are provided on Armtsrong-Siddeley, one for carbureter jet. B—Alda provides a neat oil reservoir to lubricate universal joint and shaft. C—Peugeot's unusual clutch operating gear with very fine adjustment. D—Steering swivels are centered within wheel on Armstrong. E—Increased steering post rake with comfort is provided by Bellanger. F—Section through Suere miniature eight-cylinder V-type motor. G—Majola motor has crankcase inspection plates to allow removal of connecting rods with pistons. H—Panhard provides graduated twist control for setting carbureter.

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sixes and eights, having bores less than 66 mm. (2.6 in.) and 11 of these were 60 mm. (2.36 in.) or less.

Tendencies in engine construction included the general use of detachable cylinder heads, valves on one side (80 per cent of all engines) with valves in the head increasing, unit construction of engine and transmission, elimination of the magneto, rear gasoline tanks and vacuum systems, full pressure lubricating system with hollow crankshafts and aluminum pistons.

Chassis tendencies include more general use of four-speed transmissions up to 90 per cent of the cars shown spiral bevel gear final drive, cantilever springs in the rear all brakes of the internal expanding form, elimination of shaft location for brake drums, addition of front wheel brakes, and detachable steel disc wheels.

Many manufacturers have adopted the American plan of a single or at most a very small number of models which is quite in contrast with former Continental methods. Where more than one model is produced, they invariably have a close relationship, as for instance a four and a six, a four and an eight, or a six and an eight, of the same bore and stroke, so that pistons, rings, connecting rods, piston pins, connecting rod bearings and perhaps crankshaft bearings are interchangeable between the two models. Only in the rarest cases are more than three different types of cars being built in any one factory.

In body details, running boards are now quite bare and clean, protruding side lamps are unusual, the smaller lights are embodied in the dash affixed above or below the headlights or used within them as dimmers, running boards show distinct improvement with raised edges which form scrapers for the entire length, also channels beneath which prevent mud and dirt splashing on the board. Bonnet aprons and radiator protection are more complete and better designed, while fenders are more carefully designed for both appearance and protection. Bodies as a whole present a nicer, more smooth and more pleasing appearance.

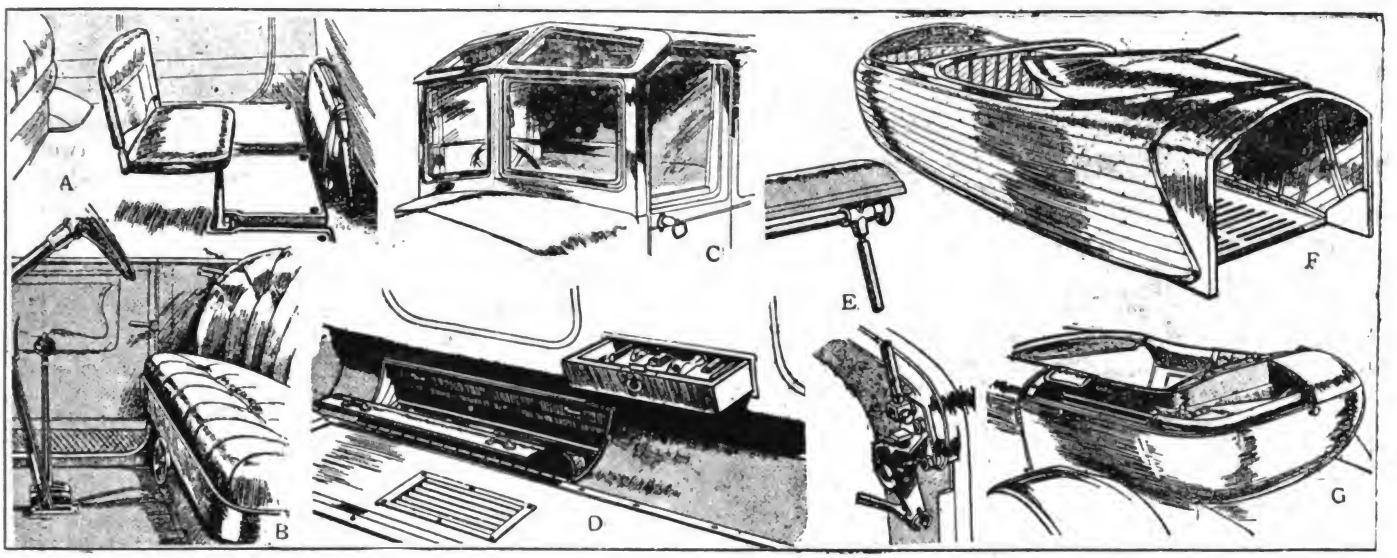
Ever stop to think more people ride vertically than horizontally—elevators!

Vehicle Men Meet in Chicago

The farm wagon department of the National Implement and Vehicle Association held its annual meeting in Chicago, November 19. The question of tire width was taken up for discussion. It is said that there is a feeling among manufacturers that tires in some cases are unnecessarily wide. Another subject to be discussed is "The Place of the Wagon on the Farm." It is believed by manufacturers, and the opinion is shared by a good many dealers, that the wagon is not receiving the attention it deserves as an important factor in farm work.

New London Bus More Like American Type

There has been submitted for official approval in London a new motor omnibus that is not unlike a small Pullman car. It has few curves and comes 6 in. nearer the road than the old type. It has a capacity of 46 passengers (22 inside and 24 out), as compared with 36 carried by the present vehicles. The upholstered seats inside are so arranged that all passengers look ahead. The driver sits on the right hand side, about on a level with the engine on the left. The steps to the outside seats are lower than in existing omnibus, all these great improvements being due to remodeling of the shape of the vehicle. Instead of having a curved body resting on a chassis which was placed rather high, the new form is square and the chassis is much nearer the ground. The center of gravity is now so low that it is difficult to conceive of the omnibus being upset, and a good feature is that there is no provision for strap hanging, which means that every passenger will be provided with a seat.



New body forms and details from Paris Salon. A—The Delahaye auxiliary seat folds into small space. B—Armstrong provides a hand wheel to adjust position of driver's seat. C—Roof lights and V front distinguish the Janior saloon body. D—Daimler accommodations for tools in drawer and locker. E—Supporting arm and locking device for Daimler bonnet. F—Streamline body fashioned after clinker-built boat, by Henri Labourdette. G—Concealing the top when down, Grahame-White sporting body on Daimler light 30.

Italy Removes Automotive Import Restrictions

Effective October 31, the Italian government has removed the import restrictions imposed by decree of July 23, 1919, from agricultural machinery, trucks, tractors, automobile chassis, iron and steel, other metal manufactures and many other articles.

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Machining Big Engine Parts a Difficult Task

BIGGER and bigger, is the cry in airplane engine practice, in marine engine work, and especially in Diesel and semi-Diesel type engines for the propulsion of ships, motor ships, as they are called. As has been pointed many times previously in these columns, an engine for ship use is now considered small unless it exceeds 500 h.p., and no engine of less than 1,000 h.p. is considered large, while there is no upper limit. That is to say, today's limit or largest size is removed tomorrow by the construction of a still larger one.

It should not be considered that these increases in engine sizes and, of course, in the parts has been made without a corresponding increase in the size of shop tools and facilities for machining and assembling them. Thus, in machining crankshafts it has been found desirable to design them so that the two halves can be machined separately and then completed by bolting the flanges together.

This was done in the case of the crankshaft built by the Skandia Pacific Oil Engine Co., Oakland, Cal., for its six-cylinder 500 h.p. marine engine, the work and tools being illustrated in Figs. 1, 2 and 3 herewith, utilized through the courtesy of Machinery. The turning of a crankpin is illustrated in Fig. 1, which shows two interesting features of this work, namely, the special form of tool support used and the method of counterbalancing the crankshaft while the crankpins are being turned.

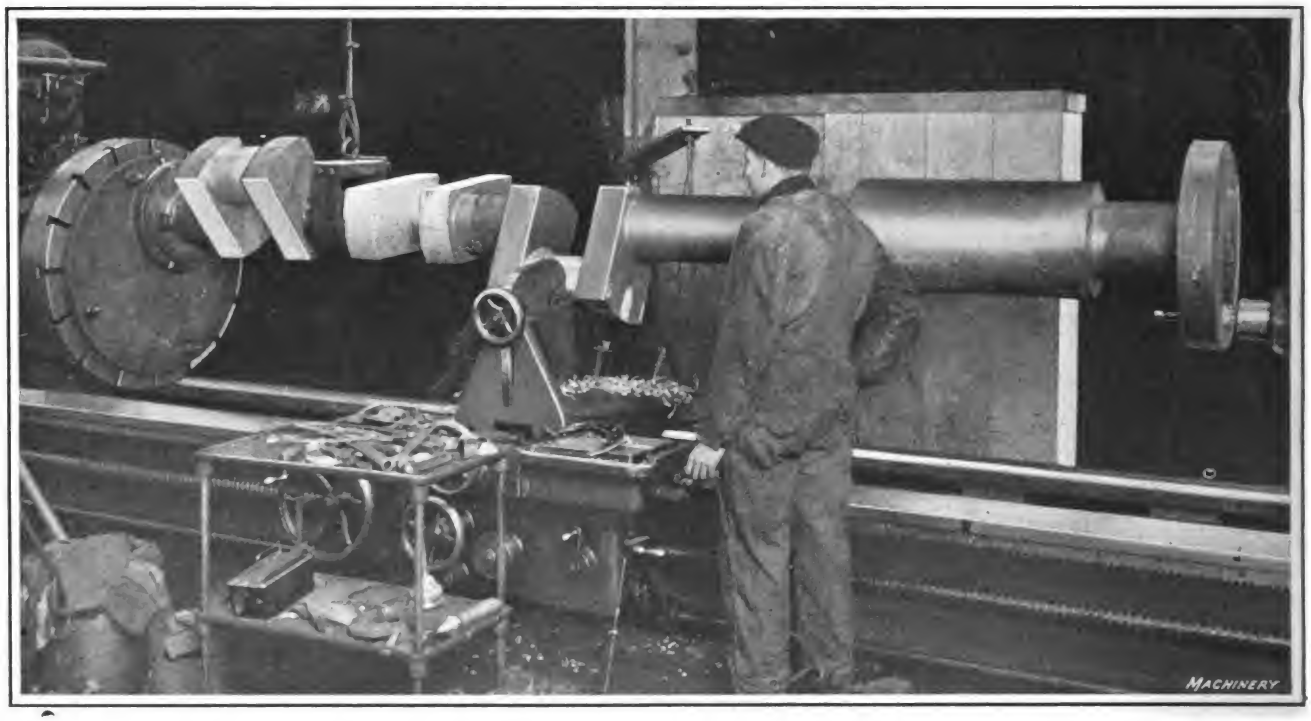

Fig. 1—Turning the Skandia crankpin. Note the special design of tool support (See Fig. 3)

The tool holder is designed to grip the tool and provide a solid unyielding support, but it has the advantage of being very narrow and does not interfere with the rotating webs of the crank. A detailed view of this tool holder is shown in Fig. 3. The base is a heavy casting which is fitted to the ways of the carriage in place of the cross-slide. A flat steel plate about 1½ in. thick is fitted and securely clamped to this base casting. This flat plate has a notch or opening near the upper end for receiving the turning tool. Just above the tool there is wedge-shaped clamp which is drawn back by means of a screw connecting with the handwheel seen at the front of the tool holder. The tool itself is provided with a groove which engages a tongue on the lower side of the notch formed in the tool plate. The rear end of the tool also has an adjustable backing screw. With this arrangement the tool is securely supported against endwise, lateral, and downward thrusts, and the tool-holding plate is so narrow that it occupies little room between the webs.

This six-throw crankshaft is formed of two sections of three throws each. These sections are flanged and bolted together and one is provided with thrust collars for the regular type of thrust bearing. Fig. 1 shows one of the sections in the lathe. The crankpins are located 120 deg. apart and each pin is aligned with the axis of the lathe by changing the position of the shaft relative to the special faceplate casting and by changing the position of the tail-stock center. Three centers 120 deg. apart are formed in a ring that is bolted to the flange at the tailstock end of the crankshaft. At the opposite end the flange fits into a circular recess, the center of which is offset relative to the axis of the lathe spindle a distance equal to the throw of the crank.

The counterbalancing of the crankshaft is effected by means of an ingenious but simple device consisting of a steel strap which surrounds one of the journals, as shown in Fig. 1, and is attached to a steel cable which passes over a pulley above the lathe to a counterweight attached to the opposite end. With this arrangement, when the unbalanced part of the crankshaft is revolving in an upward direction, the strap and counterweight assist in this upward movement. On the contrary, when the unbalanced

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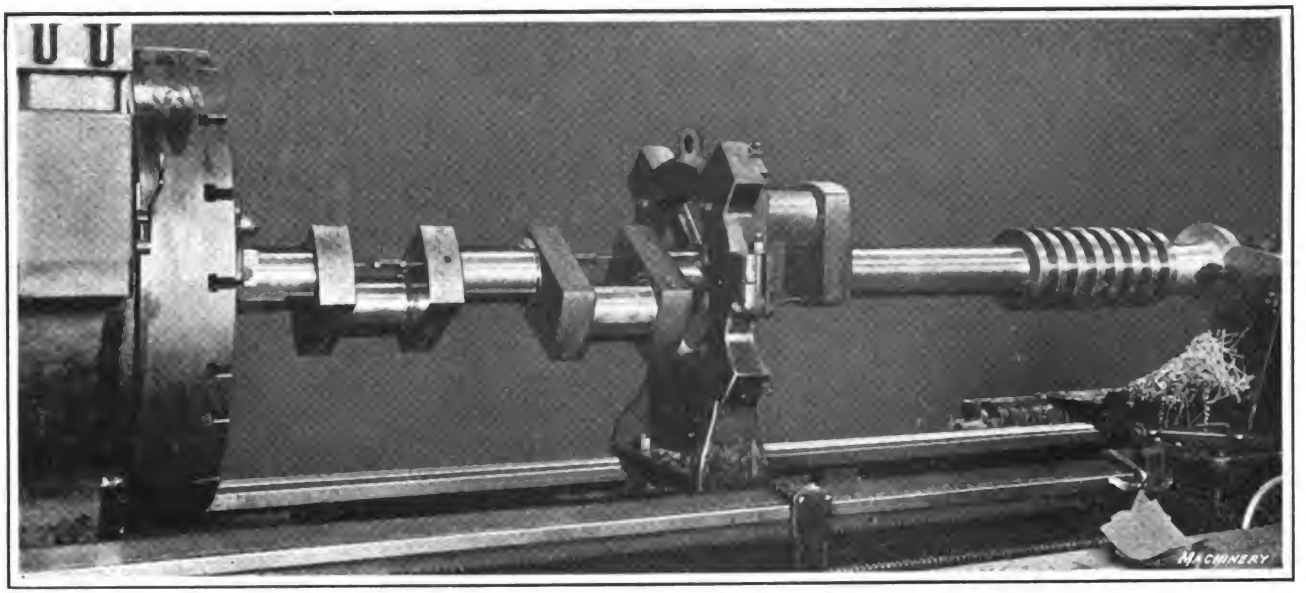

Fig. 2—Finishing the Skandia crankshaft journals after completing the turning operations on the crankpins

mass is descending, it is supported by the counterweight. It will be seen, therefore, that the effect is similar to that obtained when weights are attached to the faceplate on the side opposite the heavy unbalanced sections. The advantage of using a strap and counterweight attached to a cable is that the counterbalancing can be applied at a point that is at least approximately in the center of the unbalanced mass instead of at one end: consequently the shaft not only is counterbalanced, but its tendency to sag is also overcome.

Fig. 2 shows the crankshaft in position for finishing the journals. The center of the shaft is supported by means of a heavy steadyrest. The practice in machining these shafts is to rough-turn the journals first, then finish the crankpins complete, and finally place the crankshaft back on the main centers for finishing the journals to size. This method insures accuracy of alignment. These shafts measure 15 ft. 6 in. overall and the journals and crankpins are 8½ in. in diameter. Each crankshaft section is forged from a solid billet of open-hearth steel. All important dimensions are said to be held within a tolerance of 0.0005 in.

The Past and the Future of the File

A well known Canadian firm, making files, has sent out word with its shipment that a file is a fine tool, and as such it should be protected from rough usage. The notice even goes on to claim that better results can be secured from a well preserved file.

As a matter of fact this manufacturer is right, but we hate to believe him. The general acceptance is that a file is a utility tool and that it can stand hard usage. Therefore, it is the duty of the man who gets a file to give it hard usage.

Ever use a file as a hammer? Not as a sledge, perhaps, but just as something handy at the time.

Ever pry the lids off cans with a file? Sure. Great thing for all such odd jobs.

Ever use the tang end of a file to dig a hole in a brick? Handy for this sort of work.

Ever turn over a heap of tools to find the file you want away at the bottom, where everything else in the box has had a chance to have a kick at it? Own up now, you have.

Most people have had about as much regard for a file as they have for a crowbar. Its cutting edge is regarded about the same as the family razor that shoots father's whiskers, pares mother's corns, and, when no person's looking, sharpens the youngsters' lead pencils. The file is a sort of family instrument. Every house has one in the kitchen table drawer—that is, every well-regulated household. And there are more hanged things done with and to that family file than ever happened in a bang-up three-ring circus. It pulls corks out of a bobttle, it hammers tacks, it sits around on call when the carpet is being laid on the back stairs, and it comes into active service when the old man is wondering why under the sun the elbow from the kitchen range will not slide into the stove pipe hole like a reamed out cylinder and piston. It is the family file that crawls in beside that stubborn pipe and stays there, too, while the old man administers the final heave that puts the smoke stack in action.

Well, to be sure there may be better times on ahead for the file. It surely has had a whale of a time in its day, and when the day is over it generally gets its whiskers shaved off and does service as a screw-driver, a chisel, a scraper, a center punch, a drift or what not.—The Power House, Montreal.

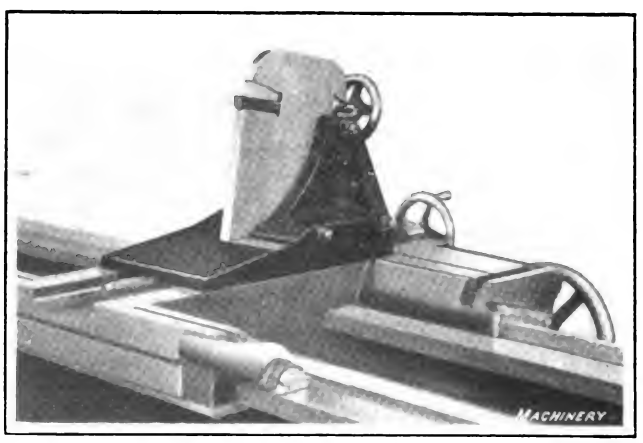

Fig. 3—Special form of tool holder used for turning crankpins

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New York Automobile Salon a Brilliant Affair

Many New Models, in Which Best Domestic Product Vies With High Class Foreign Productions—Some Post-War Tendencies

REGARDLESS of what the Automobile Salon, held in one of the fine hotels in New York each year about a month before the big display of cars, may have started as, it has developed into a showing to a limited number of people of the best American cars with a few high grade foreign machines as a kind of additional attraction. The high grade American makers who do not show their cars at this advanced display are very few in number, in fact one might say there are but two of them. The number of foreign car exhibitors, on the other hand, has been dwindling slowly but surely until this year there were but five; one of these was a newcomer, and two others limited their interest to a single vehicle or chassis.

The salon this year moved from the old familiar ball room of the Astor to the ball room of the new Hotel Commodore. The space was slightly larger, but the location is more central, making it more accessible. The extensive decorations of previous years have been entirely eliminated beyond a few flags and banners with the names of the cars. The air of quiet luxury and richness which this small display always carries makes it quite distinct from the larger shows with their tremendous crowds, noise, hustle and bustle. For these reasons it appeals to an entirely different class in their own way, and as such is and probably always will be a good business proposition for the cars which qualify. An idea of what is meant in this direction can be gained from the simple statement that the Revere chassis at $4,250 is the lowest priced machine in the display, the others varying from $4,500 upwards as high as $11,000.

Included with the better known American fine cars, such as Locomobile, Brewster, Cunningham, Daniels and Singer, there were several entirely new designs. These were: Revere, Porter, Dupont, Meteor. The foreign machines of former years included Rolls-Royce, Renault, Lancia and Delage, the English-built Sunbeam was shown. The body makers included Fleetwood, Brooks-Ostruk, Brewster and Rubay, with Barker, of London, as a newcomer.

The mixing of foreign and home product makes it somewhat difficult to draw any conclusions from the mechanical and body details shown, and to classify these as tendencies of the year. For instance, all reports from abroad relative to either the Paris Salon or Olympia stated plainly that shaft brakes were going out, yet every foreign car shown and one American newcomer had shaft brakes.

However, there were a few notable points of construction. If anything in number of cylinders can be said to have stood out it was the number of four cylinder motors shown, considering the exceedingly high average price of these cars. Thus, Renault showed more fours than sixes, Lancia displayed only a four. Brewster is made as a four only, the new Revere and Dupont both had four-cylinder motors, and the new Porter, probably the highest priced car in the show, is to be made in four cylinders only. Against this there were quite a few sixes, two eights and a new twelve, the Singer. This bears out the reports from France, England and Italy that this is to be a better year for four-cylinder motors than has been the case for a long time, perhaps four or five years. The reversion to fours should bring with it lighter weight, lower operating cost, less trouble more easily found and fixed, and other advantages of simplicity.

There is a pronounced tendency toward lower weight, this being worked out in these cars by fewer cylinders as noted above, more simple lines and many more straight lines, smaller diameters where the number of cylinders is kept up, greater use of aluminum and of alloy steels, notably chrome-nickel, more machine work as in machining connecting rods and other parts all over, and in other ways. The Porter may be pointed out as a remarkable example of this. It is a big car with a wheelbase of 142 in. and motor developing 52 horsepower at 1,000 and 145 at 2,400. Yet instead of the usual 4,500 to 5,000 pounds weight of a car of this size and type including open touring body of perhaps 800 pounds, it weighs but 3,550, or chassis only 2,750. Based on maximum power rating this gives the lowest ratio of car weight to horsepower of any American machine, less than 30 as compared with an average of about 65 for all cars, and of 55 for a selected group of 14 high class cars. This result has been brought about by the use of the best and lightest materials, and very extensive machining of them to save every ounce.

One notable feature is the tendency to give more attention to the frame design, this resulting in a lowered center level where the body entrances come. This is done in many cases by a kick-up both front and rear, as in Revere and Renault, or in an unusual rear kickup at the rear end. In the matter of frame widths, too, it is noted that these are being made wider as needed, regardless of whether this gives the side rails different dimensions at several points or not. A straight side rail was much sought after last year, but the tendency seems to be away from that where any advantage whatever results.

With a generally lower level and straighter lines, the clearance is probably less than in former years, but the cars as a whole have that much sought after long and low appearance. Strange as it may sound, in many cases this is increased rather than diminished by the elimination of the usual running board. The side apron or frame member is carried down lower than has been the case in the past, and this extending from front to rear fenders fully as long as or longer than a step would be, gave the impression of lowness and length with the actual saving of weight of the step and its supports. This same idea is said to have been quite general abroad. It has the further more or less desirable feature that it gives the car a certain sportive or racing appearance.

In the way of brakes the marked tendency is to increase the size and in a few cases the number of the service brakes. Thus, the Revere has service brakes with twice as much braking surface as the emergency. The Delage, with front wheel brakes, used these for the service in addition to the rear wheel brakes, so that by comparison with the

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single smaller emergency brake drum on the propeller shaft, the service brakes had perhaps six times as much surface as the emergency. A neat little point about these brakes was a differential action between the front wheel set and the rear wheel set, arranged to give the fronts a very slight lead, so that they take hold a fraction of a second before the rears, which difference eliminates skidding. In addition there is a differential between the individual brake units.

It was noted, too, that ribbed or air-cooled brake drums were more general, this taking the form of projecting fins or ribs all around the outside of the brake drums, which of necessity make the brake used on that drum of the internal expanding type.

The cantilever spring has not held its popularity, and has been replaced in large part by the plain semielliptic form of very flat shape, either over- or under-slung. Some of these springs are practically without camber with the body in place, or have only enough so as to be perfectly flat under a capacity load of passengers. Dupont showed a neat swivel rear end shackle on a spring of this type.

Radiators have a better appearance, as it is being realized that they have a very important bearing upon the appearance of the whole car. The V type is gaining, and in almost every case the windshield angle and sometimes its contour are planned to match up with the radiator. The sloping radiator carries with it a sloping windshield; the V front radiator and the V shaped windshield go well together, and so on. Incidentally the sloping wind shield is almost universal.

In bodies the outstanding feature was the general tendency toward straight sides, these generally being vertical, although in a few instances an outward flare showed to splendid advantage. The straight sides of the body are further emphasized in a majority of cases by a straight (vertical) member between frame and running board. Doors seem to be wider, and in general higher. This latter tendency goes with higher body sides, and in closed cars the tendency toward a higher panel and smaller light of glass above it, is particularly noticeable. A few bodies show the sloping edge at the top of the open body, but that has not been taken up as much as abroad. A few bodies with this have the edge finished in natural wood. Enclosed bodies show a tendency toward the use of more wood than formerly. Inlaid wood is used for panels within the body and in a few cases in the top, for panels on doors, for the backs of the front seat, and elsewhere. A particularly fine brougham body by Kellner, of Paris, on a 40-60 Renault chassis had practically the whole interior of inlaid white mahogany. It makes a most beautiful display. American bodies as a whole showed a cleaner appearance than the imported ones, all of which carried tool box, battery box or other running board obstruction. Rubay showed a four-passenger body on a Marmon chassis which had the whole interior finish of natural wood and cane work.

Court Dismisses Locomobile Application in Licensing Agreement

The United States District Court for the Southern District of New York, Judge Hand presiding, has dismissed the case of the Locomobile Co. of America against National Automobile Chamber of Commerce, Inc., in which the former sued to have the Cross licensing agreement declared void and cancelled. This agreement, entered into by more than 100 manufacturers, provides for an exchange of patent rights without the payment of royalties, and by industry generally has been considered a highly helpful co-operative and constructive arrangement, working to the ultimate benefit of the buyers of motor cars.

Judge Hand, in dismissing the bill with costs, states that no leave to amend will be granted unless the complainant states its desire to have this right because it can bring in the lacking indispensable parties, that is those who furnished patent licenses under the agreement. The defendant has no licenses. Counsel for the N. A. C. C. express the opinion that this will require the Locomobile company to join together all the members of the Chamber who are parties to the cross-licensing agreement as defendants in a single suit, which would be extremely difficult because there is no one district in the United States where all the cross-licensees jointly can be sued.

Advertising Air Expresses Now

In the November 13 issue of Aeronautics (London) there appeared a full page advertisement of the London-Paris air express, which is interesting as it shows the extent to which air travel has grown when regular daily flying service can be maintained between two such large cities, a considerable distance apart. In addition it is probably the first advertisement of this kind which has ever appeared.

From the notice it appears that in the first 11 weeks of flying there were 19 days officially noted as "unfit" for flying, and 30 unfavorable, leaving but 17 days which were favorable. In this period, however, 166 flights were scheduled and 149 accomplished. Eight were prevented by the weather, six were interrupted by weather, and only three by mechanical defects. A total of 39,000 miles was flown, and at an average rate of 105 m. p. h.

Many New Records for Duesenberg

On three separate days recently, November 18, 24 and 25, new automobile records were established by Duesenberg cars at Sheepshead Bay, New York. These were by James Murphy, who drove a motor of 183 cubic inches capacity, or slightly larger than a Ford motor, for a new 300-mile record of 3 hrs. 15 mins. 44 secs., and by Dave Lewis driving an overbored 300 in. motor which is placed in the 439 cu. in. class, for a new 100 mile record of 53 mins. 25.4 secs. Subsequently, Tommy Milton and Lewis, each driving a 300 cu. in. Duesenberg set new marks for all distances from 30 to 300 miles, including two and three hours, and Milton hung up a new world's record for one hour, in an eight-cylinder 300 in. motor. The mark made was 113.5 miles and replaced a foreign record of slightly over 112 m. p. h., made in a twelve-cylinder Sunbeam.

More Federal Money for Road Construction

According to a bill recently introduced into Congress by Senator Sheppard, $100,000,000 per year for the next four years would be available for additional road construction under the Federal Road Aid Act of 1917. The bill provides that where sparsely settled states find it difficult to meet the federal funds in an equal amount, the Secretary of Agriculture shall have the power to pay more than 59 per cent of the cost.

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The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

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Vol. LXI NOVEMBER, 1919 No. 8

Some Light Weight Motor Car Considerations

SEVERAL years ago a prominent motor car manufacturer by simplifying the design of his machine, that is eliminating parts, combining the functions of two or three into one, and by the extensive use of light weight metals, cut off at one swoop 500 pounds from the weight of his car. At about the same time another manufacturer advertised that he had eliminated more than 100 parts. Since that time we have progressed a long ways, and design work is generally much better, the light weight metals are much better understood and their limitations known. Consequently there is no reason why the present demand for a more economical car, which is but another way of saying a car of lighter weight, can not be answered satisfactorily.

The salon which has just closed in New York uncovered a high grade big car with a chassis showing a saving of almost 1,000 pounds, compared with other cars of equal size, carrying capacity and general similarity. This was accomplished by the very liberal application of airplane construction, that is the wide use of high-tensile alloy steels, machined all over. Weight is saved, and in a tremendous proportion, but at such an increase in cost as to make this anything but practical. This particular car runs into so much money that it will take rank as one of the highest priced cars made, despite its very low weight.

Obviously a modest application of this method, combined with a more free use of aluminum and magnesium alloys (magnesium being even lighter than aluminum), and complete use of the possible savings through elimination of parts, if coupled with the weight saving which it is said plywood will effect, can make a very large and noticeable difference in all of our cars.

That the output of the aluminum manufacturers of the country has been increased about 50 per cent during the war is an important item, with a bearing on this general subject. So, too, is the fact that one well known maker of aluminum has developed an alloy with considerable strength and great toughness especially for the unsprung parts, that is the axle parts below the main vehicle springs. Of this metal it is said that a 90-pound casting for a truck axle housing not only replaced a cast steel member weighing 175 pounds, but that the former withstood nine tons load without breaking, while the latter under six tons load showed a permanent deflection of ½ in. While the weight saved is but 85 pounds it amounts to 50 per cent and opens up remarkable possibilities in the reduction of unsprung car weight where a pound of saving is more effective than five or six pounds (some say ten) above the springs.

The war uses of plywood gave us a keen insight into the wonders which could be worked with this in various structures. Applying all this new knowledge to the problem, especially at this time when economy is sought so strenuously, should result in some marked benefits.

In this connection it should be borne in mind that every weight saving makes possible quicker acceleration, better hill climbing, more speed on the road, easier riding, greater economy, or if it is desired the size of the motor can be reduced to a proportional size and with additional weight saving so as to obtain present acceleration, hill climbing and speed, with even greater economy of operation, care and repair. Truly, the lighter weight problem will give our engineers something to think about in laying down their post-war designs.

What the Shows Show

NOW that the first of the automobile shows has come and gone, it is possible to summarize what these have uncovered in the way of new things, either of design and construction on the one hand, or of general tendencies on the other. By first, reference is had not alone to the first American, but also to the first French and the first British displays.

It would seem that the first and most noticeable item is improved methods of manufacture, or perhaps this might be worded, improved workmanship. This has had a tendency to increase prices, in fact in France it has taken all the former medium priced cars into the high priced luxury class, but in this country no such results are expected due to increased production. The latter is no mean factor for practically every automobile firm of any consequence is figuring on an output for 1920 greater than 1919 by 50 per cent or more.

Even with this better workmanship there is a pronounced trend toward economy of operation. The better workmanship would be one factor in this, the choice of motor type and size would be another—abroad they are uniformly smaller, more compact and an increasing number are of the four-cylinder type, tires are smaller, springing and weight distribution are better, the details of carburetion and others have been worked out with the idea of getting better mileage per gallon of fuel, and poorer fuel at that. Summed up, all this means that the 1920 cars are going to be better looking, easier riding, more quiet, and much more economical of tires, fuel and oil, while better materials, design and workmanship should add to these the other factors of low upkeep and repair cost.

The only thing in this world that is really what it is cracked up to be is ice.

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Preserving the Finish of the Car

While the device which is about to be described was essentially a garage outfit, it should interest manufacturers for the latter very often find it convenient or necessary to do additional work upon a finished job. In addition, body builders often find that the motor or other mechanical parts need skilled attention after the car has stood in the shop waiting for a special body to be finished and fitted to it. This does not develop until the body is completely painted and varnished, so that the protecting device to be described would be of great utility among the

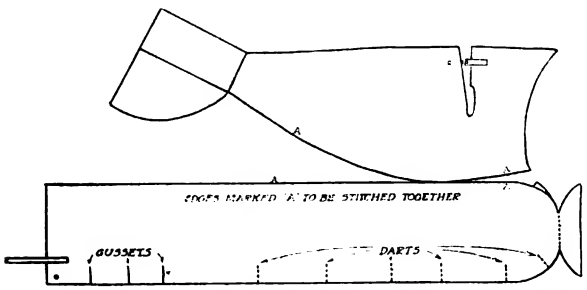

Fig. 1—Layout or pattern for fender-protecting work cover

body builders. Private car owners, too, will find it helpful in that it enables them to work upon the motor or its parts without harming the finish of fenders in any way.

Indignant motorists claim that at times a few minutes' work on the part of a mechanic on the engine, carbureter, magneto, or some other part of the inner works of the machine involves a greater expenditure of time and labor to fix up scarred or dented fenders, hood covers, or doors than the necessary repairs cost.

A garage manager in an eastern city recently hit upon

Fig. 2—Application of fabric work cover to fender of Cadillac car

a device in the shape of a fender and door protector which reduces such complaints to a minimum.

The accompanying illustrations show what the fender protector looks like. It is made of a leather substitute consisting of a strong cotton fabric base coated with dope. It has a pocket along the outside edge into which the edge of the fender is inserted. A flap on the cover runs down on the inside in such a way that the fender is entirely covered while the mechanic is leaning over it to work inside the hood. Thus the buttons on his clothing cannot scratch the varnish, nor is any harm done if he drops a tool or lays it down on the fender.

The material of which the protectors are made has a heavily napped back which provides the best kind of protection for polished metal surfaces. The protector is thick enough to adequately cushion any ordinary friction or striking. The covers may also be used to protect the cars while standing in garages, preventing injury to fenders or doors by being struck by other machines while being moved in or out of their "holes" in the garages.

Similar protectors are being successfully used in this garage to protect the inside upholstery of cars from being soiled by the greasy clothing of workmen who may be making interior repairs.

Any grease or dirt that gets on the protectors themselves can be very easily washed off with soap and water.

The illustrations present this very clearly. Fig. 1 shows a pattern for cutting out the material and sewing it, while Fig. 2 presents the finished article in use.

Townsend Bill for National Highways Progressing

At a recent conference in Washington between Senator Townsend and those interested in his Federal Highway Bill (Senate Bill 1309) he stated that the pressure of other measures would prevent the bringing up of this bill until late in December or perhaps January. At that time, however, he said the committee would immediately take up this measure, hold hearings, and put the bill in its final form to be presented to the Senate. It is therefore very important that anyone wishing to make suggestions in regard to any amendments should immediately send them in.

Senator Townsend stated that the purpose of the bill was to take care of interstate traffic, to serve the large centers of commerce in each state, to meet the military needs of the country, and to tie the country together in a unit so that it will be possible for the states to plan and connect their systems with the national system, and thus connect the important commercial centers. The counties would then connect with the state system, and build out fom the centers of population into the farming communities like the spokes of a wheel, forming a road plan that would do the largest number of people the greatest good. Each unit would be made more effective and efficient and the farmer would be given a number of markets instead of one, for his produce. This road plan would greatly reduce the cost of transportation and lower the cost of living to the consumer. In other words, the national highway system would form the backbone of the main commercial arteries of the nation and greatly stimulate the states to connect up their systems with the national system as well as the counties to connect with the state system, thereby making a general road plan that would effectively meet the road needs of the country. A plan that could be brought about and built in the shortest time at the least possible cost and one that would be of the greatest value to all the people.

The total number of cars, trucks and motorcycles in use in Great Britain, according to recent license summaries, is 411,791, of which commercial vehicles amount to 85,225. Private cars total 93,947, private cycles 56,309, doctor's cars 12,073, hackney cars 25,827, and others for industrial purposes 61,805. The exact total of cars and cycles can not be determined because the new series are grouped together.

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New and Improved Ideas in Body Finishing

Painting An Automobile in Purple

A too delicate color, perhaps you remark. It all depends upon methods of application and the amount and kind of protection given. The purple automobile has during the past half dozen years won enough admiration in the chief cities of America, where fashion is fastidious, to create an uproar if confined in one town. Purple is a color of magnificent tone and brilliancy if properly developed, and the fact is that a particularly "smart set" color gives to it a prestige which the painter looking for attractive creations cannot afford to ignore.

In order to develop the color in proper shape burn the surface, whether new or old, along the usual way, guarding against defects, which of all kinds and degrees are difficult to remedy when once the ground color is laid. Make the ground color of blue, eight parts; red, five parts, this combination being in effect a true secondary color, and by the same token a correct purple. A couple of coats of this color will fetch the ground color out solid and strong. Then with superfine perfect purple, mixed in elastic rubbing varnish to a free, flowing consistency, coat in the surface. Stripe in lines of gold and black for finest effect. Finish with a very pale finishing varnish, and admonish the car owner to keep the color well protected with varnish.

Motor Truck Painting Different From Car Finishing

The painting of motor trucks offers problems not encountered with other vehicles. The truck owner wants just three things in the painting of his truck: durability, ornamental features and advertising value. The truck as a rule, is not a thing of beauty nor will it last forever. Good paint and good varnish,a good covering, will increase its years of usefulness and furnish its owner a measure of satisfaction and a degree of commercial advantage which it is not easy to compute offhand. What the truck owner is chiefly concerned with is a class of painting which both serves certain advertising purposes and a measure of protection concerning which no fault can be found. The one thing above all others which is necessary in motor truck painting is durability. This is not easy to secure on a vehicle made up of metal and wood parts put together in a manner to impose unusual strain upon the paint and varnish fabric.

Two classes of primers are necessary in the priming of new trucks—one for the metal and another for the wood. The metal surface is, in respect to its capacity for absorbing oil, a negative one, whereas wood is quite the opposite. To meet the requirements of these two extremes the painter must provide a material in the one case carrying at least 25 per cent more oil than that required for the metal surface. This ratio of linseed oil will enable the metal primer to fortify itself with practically the same measure of elasticity as the oil primer used over the wood surface possesses.

In the repainting of trucks this rule holds true.

In all cases, whether new or old work, a very certain and sure proportion of raw linseed oil should be used in all the primary surfacing coats and in the color coats. This will insure an adequate binding property for these pigments and put them in a position to durably hold out the varnish coats. Thus provided for, these coats will look and wear bravely.

The Proper Selection of Drying Oils

The selection and use of oils for the products of various industries requires the constant care and skill of the chemist and the factory superintendent who have been trained to know the properties of each type and the service they will perform. The use of oils without such information often results in the production of inferior articles and suggests the advisability of using products that are made under the guidance of skilled technicians

Some of the more important considerations in oil selection are given below. There are also presented constants of specifications for raw, boiled and refined linseed oils, as recommended by the U. S. Interdepartmental Committee on the Standardization of Paint Specifications.

Moisture in such oils as linseed may be held responsible as the active agent that often causes the formation of free acid. The removal of moisture by heating raw linseed oil to at least 105 deg. C. will guard against such development. Products with which the oil is used should be kept in a thoroughly dry condition so that moisture from this source will likewise be excluded.

Sediment of roots in raw oil are made up largely of mucilageinous and nitrogenous substances and moisture. These products are objectionable and are often the cause of drying troubles. They further serve the purpose of ideal sprouting media for microorganisms. The use of foots-free, well filtered oil is suggested.

The use of rosin and rosin driers of an acid nature in a promiscuous manner is to be avoided, as they are often the cause of troubles that later develop. For this reason, boiled oils of the linoleate type are to be preferred in some products to those containing resinate driers.

Refined oils should be used with care. Acid refined oils often contain the sulphonic acid radical that may continuously affect the formation of free fatty acid over a long period. While refined oils having an acid value of 9-10 are desirable for some work, those having an acid value of not more than 6 are generally preferred. Alkali refined oils are substantially neutral and may be used with much greater safety. The lack of grinding properties possessed by alkali refined oils would suggest their use rather as thinning media to be added to products ground with moisture-free raw oil of normal acid value.—H. A. Gardner, in The Modern Painter.

Full Lustre Finish Only Wearing Surface

The forthcoming automobile shows, like their predecessors, will demonstrate that novelties in body finishes are not lacking. But they will also demonstrate that the general public does not want these peculiar (not to say freak) finishes because they do not wear well. On the majority of cars shown in recent years there has been one of these styles of finish used. First, the full lustre finish of many years standing and deservedly the most popular finish of this or any previous day; second, the dull rub finish produced by rubbing the finishing coat with water and pulverized pumice stone and then polished with rotten stone and sweet oil; third, the semi lustre or "house paint"

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finish, as it is dubbed by carriage painters. The last finish is produced by bringing the surface up in the usual way and then using for the final coats colors carrying enough oil or varnish to dry out with an egg-shell gloss or with a gloss approximating this. This finish with certain colors such as, for example, the grays and browns, presents a rather pleasing appearance when new, but on the whole it is a short-lived finish due in large part to the fact that it is practically impossible to wash this finish without detrimental results.

The exceeding difficulty in maintaining these house paint finishes furnishes the main objection to their use. A little investigation as to the composition of this class of finish will convince almost any one, and most certainly any practical carriage painter, that they are not properly compounded to give the best kind of service.

One of the most troublesome features is that the more the dull finish here spoken of is washed and cleaned the less able it is to take care of itself. The full varnish lustre finish, on the other hand, not only yields itself to frequent washing but thrives by it and furnishes good protection for the color beneath.

The Use and Abuse of Priming

The priming coat, from times most ancient down to today, has been a bone of contention among automobile, carriage and wagon painters, perhaps more so in the rush and hustle of modern high quantity production than ever before. It is to the credit of the craft that today, as perhaps never before, this first coating operation and the material employed are alike respected for the very vital part they play in the painting of vehicles.

The primary coat, preceding all the other coats, performs a function which all the other coats combined cannot, in the very nature of things, perform. Why not, then, pay diligent heed to this important coat? First of all, the primer should be a medium principally liquid, endowed with these essentials, to wit: penetrativeness, adhesiveness, elasticity, compactness and uniformity. Pure raw linseed oil has always been acknowledged the oil par excellence for priming purposes. Used alone, however, it penetrates too deeply and thereby defeats the purpose for which the primer is designed. For this reason the painter adds a tarce of pigment—white lead preferably, although various other pigments serve the purpose well—to the oil and thus checks the extreme penetrative property of the oil. Raw linseed oil in these days of rapid living, when flying machines are no longer a novelty, cannot always be used alone with its bit of pigment, and so turpentine and japan drier are made to perform a part in the modern priming material. Over hard wood the oil and pigment is made to carry, say, one-fourth turpentine to three-fourths oil, and over some soft wood panels it is often found advisable to use quite the same amount of turpentine. This thinning of the oil brings it to and into the wood in a thinner body, in which state oxygen applies its energy more effectively, thus promoting the drying operation and giving quicker results without robbing the oil of its required strength to any appreciable extent.

The priming coat, moreover, should be carefully applied; brushed on smooth and clean, and worked carefully into the pores of the wood in which condition it is better qualified to perform its appointed tasks. The former notion that "anybody can put on primer" has passed away. The modern belief, sustained by experience, is that only skillful brush work can accomplish the right sort of priming.

Varnish Protection Must Be Ample

As time goes on and data accumulates, it is becoming more and more evident that the finish on the automobile to give best results must not only be renewed frequently, but when renewed made strong enough by a sufficient body of varnish to stand up secure and fine against the hard service regularly imposed upon it. The car, as a rule, has not had adequate varnish protection. When new it was probably fairly well varnished, and in the case of the better makes of cars, excellently varnished. But in medium-priced cars the body of varnish has not been adequate to meet the urgent needs of the color and the pigments supporting it. The results have been, and continue to be, that these colors and undercoats do not give the measure of wear which they otherwise would. The motor car should be varnished at least twice every year and when necessary two coats should be applied at each shopping of the car.

Automotive Fuel Committee and Their Work

The plan of the automotive fuel committee, consisting of representatives of all bodies interested in the present fuel situation, is to insure an ample supply of fuel and its economical use. The first objective is the burning of present fuels and those of the next three years more efficiently.

Those comprising the committee are: H. L. Horning, representing the Society of Automotive Engineers; Henry M. Crane, representing the Manufacturers' Aircraft Association; M. L. Heminway, general manager Motor and Accessory Manufacturers' Association; Henry R. Sutphen, National Association of Engine and Boat Manufacturers; T. C. Menges, representing the National Gas Engine Association; E. W. Dean, Bureau of Mines; E. A. Johnston, National Association of Implement and Vehicle Manufacturers; K. W. Zimmerschied, National Automobile Chamber of Commerce, and H. C. Dickinson, Bureau of Standards.

The time limit which had been set on the inspection of German motor trucks, as mentioned on page 13, October issue, has been extended. It is expected that the work of disassembling the engines will be completed by November 15, so that any time previous to the conclusion of this would be the best time for interested manufacturers to examine the vehicles and their parts.

Electrical Plowing Successful in Italy

In some sections of Italy electric current is remarkably cheap because it is generated in simple, low cost installations on mountain streams. This cheap electric power by comparison with gasoline or other motor fuels at $1 a gallon has given great impetus to things electrical as compared with the usual liquid fuel engines used in other parts of the world.

In view of the necessity for improved methods of cultivation in Italy, considerable interest is being displayed in the possibility of utilizing some system of electric plowing on a large scale. In this connection trials were recently held in the vicinity of Rome of the apparatus designed and manufactured by Violati-Tescari Bros., at which the King of Italy, the Italian Minister of Agriculture, and

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other prominent officials were present. It is reported that the results of these trials were very satisfactory, a triple plow being employed in the first instance, which operated perfectly, and in the second place a single plow, with which a depth of about 20 in. was reached in spite of the difficult character of the ground on which the trials were held.

Conditions in Italy are very favorable to the adoption of electric plowing. Not only is the necessary power available in almost every section of the country but the fields are comparatively small and in many instances level. It is claimed that by the Violati-Tescari system a hectare (2.471 acres) can be plowed for about 80 lire ($15.44), including in this sum the increase which has already taken place in the wages of the workmen, possibilities of further increases, interest on invested capital, amortization, etc. The cost per hectare, using tractors or other mechanical means, is estimated at 300 lire ($57.90), owing principally to the extremely high price of fuel.

The Violati-Tescari system of electric plowing is a comparatively simple one. At one corner of the field to be plowed a powerful electric capstan or winding apparatus is established, from which wire cables are stretched entirely inclosing the field in question. At the two near corners these cables pass through pulleys which are securely anchored, while at the far corners they are connected with two movable anchor-wagons. Between these two, a duplex plow pounted on wheels is drawn backward and forward across the field by means of the cable, and each time a furrow is plowed the anchor-wagons move up a sufficient distance to bring the plow into position for the next operation.

The plow is provided with an equal number of shares on each side of the wheels, facing each other, so that no turning is necessary; when one side is worked the shares on the other side are lifted clear of the ground. A seat is provided for the operator.

German Automobile Combine to Oppose Americans

There is a movement on foot to organize German automobile manufacturers into what appears to be a cartel similar in form to the German dye syndicate. The object of this organization would be to diminish costs of sales and to operate an agreement whereby each factory would limit the number of types which it makes. The first results of this movement have been the establishment of the so-called Gemeinschaft Deutscher Automobilfabriken (Association of German Motor Vehicle Manufacturers), by the Nationale Automobil Gesellschaft, the Hansa-Lloyd Wedke A. G. of Bremen, and the Brennaborwerke at Brandenburg. These three concerns have made an agreement covering their manufacturing program, and are said to have agreed also to have their local sales conducted jointly.

The Berliner Boersen Zeitung of September 20, 1919, contains a statement of the views of Dr. Allmers concerning the movement in general. He believes that the only way successfuily to fight the competition of American automobiles abroad, and also in Germany, is to reduce costs of construction and sale. Every automobile factory should make as few types as possible: manufacturing should be conducted according to the most modern methods; those American methods which are superior should be adopted; the quality should be maintained. It is a useless waste for each factory to maintain its own agents in every city. Selling could be conducted much more cheaply and just as effectively by a single agent in each place. The Association of German Motor Vehicle Manufacturers recently held a meeting at which these points are understood to have been discussed. So far as is known no actual results were accomplished at that meeting.

Germans Must Find Use for High-Cost Aluminum

The Association of German Engineers at the request of the government has just issued a book dealing with the future of the German aluminum industry. This work states that the shortage of aluminum and the heavy demands for aluminum wares for army use led to the erection of a number of factories in 1916, and that the annual production was thereby greatly increased. It is expected that these concerns will be in a disadvantageous position in their endeavor to compete with foreign firms. The principal reason is that the construction of the new factories involved a greater capital investment than the construction of the foreign factories. It is estimated that the annual consumption of aluminum in Germany will be between 30,000 and 70,000 tons. Before the war it was only 10,000 tons. Manufacturers are complaining about the decrease in output which has been occasioned by the inauguration of the eight-hour day.

As in this country and France a considerable quantity of this light-weight material probably will find its way into motor vehicles of all kinds, where it reduces total weight, and thus upkeep and running cost. In fact automotive experts have predicted that the car of the future will be made largely of aluminum, aluminum alloys and special steels.

Many Motor Car Companies Doubling Output

Reports from all over the country seem to indicate that the extra plant facilities resulting from former war activities, plus the buildings and equipment added this year, will give all the larger motor car and truck companies a double output for 1920. A report from Detroit states that the Hupp company, which produced 9,400 cars in 1918, probably will total close to 18,000 this year, and next year's plans are on the basis of 20,000 minimum. Oakland cars are to be brought out to a total of 100,000, the new Mercer organization is figuring on 250 a month or perhaps 2,500 for the year; Atterbury is doubling its plant, which probably means doubled truck output; Cole now practically sure of a total of 6,500 in 1919, will build 12,000 or more in 1920. Chandler plans for 25,000 in the coming year; output of the Overland 4 has already passed the 300-a-day mark and is being increased rapidly, which would seem to point to an output of about 125,000 or more of this size and type, as well as the 1,000 a day announced as the goal on the new Overland Six to be built in the east.

Templar, in Cleveland, has planned for 10,000; Essex and Hudson outputs are to be doubled; Packard now turning out 25 trucks a day, figures on 1,000 a month next year, and so on.

From all over the country come these reports of doubled plans for 1920, and yet state registrations seem to show a production for this year of close to 1,700,000. If the larger plans all carry through it would mean about 3,000,000 cars and trucks to be marketed in the coming year.

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Helpful Hints for Designers and Draftsmen

Some Important Patent Matters

As was noted on these pages in the last issue, every designer is in substance an inventor, and consequently greatly interested in all patent matters. Some most unusual situations have arisen during the war because of the suspension of the normal patent restrictions in some cases, and because of the creation of new patent laws and restrictions in newly created states and countries.

Belgium Patents and Trade-Marks

Belgium, commencing her activities once more after the war, has again set in motion the wheels of industry, and protection for industrial property by way of patents and trade-mark registrations may now be obtained.

Relative to extension of time: 1. Filing of Applications It is believed that the government as the result of war conditions, will soon grant an extension of time for the filing of applications based on foreign applications filed for more than one year, so that rights of priority will be extended for a sufficient time to enable foreign applications to obtain full protection. As the extension will scarcely exceed a limited period after the conclusion of peace, prompt action should be taken.

2. Patents—Payment of Taxes. In August, 1914, the King suspended until an undetermined date Art. 22 of the patent law referring to the payment of taxes. It is probable that the annuities which have accrued on existing patents will now be required to be paid within a short time after the conclusion of peace.

These payments should be made as soon as they are required, for all patents which it is desired to maintain in force.

Patents—Workings. Workings of Belgium patents suspended during the war should be commenced without delay.

Travancore Patents

Under the laws of August 7, 1915, patents are granted for 14 years from the date of application, to the inventor, or to joint applicants where one of the applicants is the inventor, or the legal representative or assign of such inventor, for any invention which has not been publicly used or been made publicly known in Travancore prior to the filing of the application therefor.

Full particulars as to charges, etc., will be supplied upon request.

Patents and Trade-Marks in Czecho-Slovakia

This new state comprises Bohemia, Moravia, Austrian Silesia, and the Slovak part of Hungary. It has a population of 13,000,000 inhabitants, and an area of about 130,000 square kilometers, and includes the most important industrial districts of the former dual monarchy, Austria-Hungary.

Laws have already been promulgated and are in force dealing with patents and trade-marks.

A patent bureau at Prague has already been established, commencing its activities as of January 1, 1919.

The first law, of November 2, 1918, confirms all the laws which were in force within that territory at the date of its declaration of independence, including the Austrian law relating to patents of January 11, 1897; the laws relating to trade-marks of January 6, 1890, and July 30, 1895, and the law relating to designs and models of December 7, 1858.

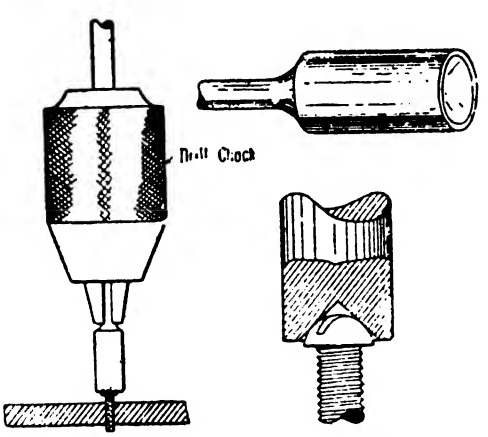
A modifying and supplementing law will be presented as soon as possible to the National Assembly to provide for the new political conditions, and for changing Austrian and Hungarian patents into Czecho-Slovak patents.

Old Patents. It is proposed to permit Austrian patents already issued to remain in force in former Austrian territory, and existing Hungarian patents to remain in force in former Hungarian territory (Slovakia), if owners make application therefor at Czecho-Slovak patent bureau within a reasonable time (probably up to June 30, 1919).

Pending Applications. Applications filed in the patent offices at Vienna and Budapest, already published or still pending, will have the priority of their date of filing if they are registered at the Czecho-Slovak patent bureau within the above mentioned time.

Patents—Duration, Taxes, Workings. It is proposed that these will not undergo any change.

Trade-Marks. By decree of December 31, 1918, No. 2074, trade-marks already filed in Vienna will remain in force in Czecho-Slovakia, but their owners must file their applications anew at the Chamber of Commerce and Industry at Prague not later than June 30, 1919. The portion elapsed of the period of protection is to be deducted from the legal period of ten years. All lawsuits relating to trade-marks must be started anew.



International Conventions. By decree of December 31, 1918, the Chamber of Commerce and Industry is charged with the execution of the registration of trade-marks requested by citizens of foreign states under international agreements.

Charges. A statement of charges for the filing of applications, payment of taxes, workings, etc., will be supplied upon application.

Simple Device for Driving Round Head Screws

When a person has to drive a great many round head screws, a simple device can be constructed which will allow of driving these by means of power, using a drill chuck. This is accomplished by taking a brass or iron rod 5/8 or 3/4 in. in diameter and drilling or countersinking one end just deep enough to fit the head of the screw. The drill used in countersinking should be ground off to a taper or a point, which will give a more conical hole. By

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filing in several notches this will give the tool a better grip. By turning off the shank end the tool may be used in either a drill press or a lathe and the screws may be run in by power. If the screws have a nickeled or polished finish the tool may be made of fibre and there will be practically no danger of grinding or marring the finish.

Some Uses for Lignum-Vitae Wood

In a recent number of the Scientific American Supplement, some interesting information concerning lignum-vitae is given by F. J. Record. It is stated that of all the woods in existence, true lignum-vitae is the only one that has been found equal to such service as is required for bearings for the propeller shafts of battleships, destroyers, etc. The peculiar properties of the wood which adapt it for this purpose result from the arrangement of the fibers and the resin content of the sap cells. The fibers do not run straight up and down the log, but weave back and forth in a serpentine manner, crossing and recrossing like the corded fabric of an automobile tire. The result is a material of extreme tenacity and toughness. When the sap cells cease to function, every nook and crevice becomes filled with a resin which is about a third heavier than water. The wood weighs about 80 lbs. per cubic foot. There are many other uses for this valuable wood, such as rollers for casters, mallets, sheaves or pulleys, stencil and chisel blocks, dowels, wooden cogs, water wheels and block guides for band saws, etc. In building the Panama canal, true lignum-vitae made the most serviceable railroad ties that could be obtained.

Temperature Measurements and Meaning

One thing which engineers have to deal with is temperature, both in its measurement and manifestations, or influence upon structure and form of certain materials. The design of many machines would be the most simple thing in the world if it were not for temperature action, as for instance the heat produced in all rotating electrical machines like generators, dynamos, etc. On the other hand, there are many devices or machines designed for the specific production of heat. Thus the production of heat, whether designed or actual, is of vital interest to the designer. What happens to the things we are all more or less familiar with in the presence of different degrees of heat will therefore be of more than ordinary interest to our readers. For this reason we publish here, by courtesy of the Pyrolectic Instrument Co., of Trenton, N. J., a self-explanatory chart and some comment on the effect of temperature both low and high—low and high temperatures being merely relative terms—on matter, on the attributes of matter, and on life itself.

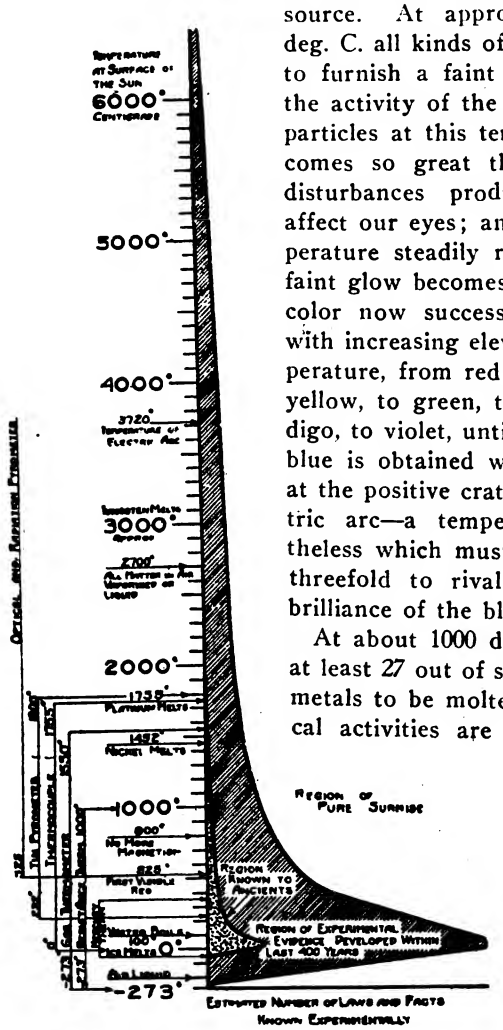
At the base of the chart at "absolute zero" or—273 deg. C, we may properly conceive all matter to be without motion and without energy. Thermodynamically at least it is dead. This final condition, while never yet actually attained, has been very closely approached; and in that state where hydrogen is frozen and "helium gas" has become liquid, a bare 1.6 deg. from the absolute zero, we have been able to study and observe a few of the properties of matter.

At —200 deg. C. air is liquid, and by its use this temperature is very easily producible, affording a convenient means of aiding investigation and research. At this temperature we detect the presence of biological life. Here are found to exist certain forms of bacteria which still survive these severe conditions of temperature.

Other forms of life occur only when we attain a temperature of about —40 deg. C. At this temperature the higher order of animal life takes its permanent abode on earth. Antartic explorers find the emperor penguin living comfortably in large flocks where, as Amundsen recorded, the temperature never rose above —5 deg. C, and where it often remains as low as —40 deg. C.

At 37 deg. C., the blood heat of warm-blooded animals, life thrives upon this planet. But ascend only 63 deg. C., where water boils, and all life, including even the hardy bacilli, is destroyed.

In the range from 100 to 525 deg. C. matter exhibits no life phenomena and it is not self-luminous. To be seen, it must be illuminated by the light of an independent source. At approximately 525 deg. C. all kinds of matter begin to furnish a faint visible glow; the activity of the motion of its particles at this temperature becomes so great that the ether disturbances produced thereby affect our eyes; and as the temperature steadily rises, this first faint glow becomes stronger, the color now successively passing, with increasing elevation of temperature, from red to orange, to yellow, to green, to blue, to indigo, to violet, until the dazzling blue is obtained which is found at the positive crater of the electric arc—a temperature nevertheless which must be increased threefold to rival the dazzling brilliance of the blue stars.



At about 1000 deg. C. we find at least 27 out of some 50 known metals to be molten, and chemical activities are so immensely increased that the identity of most all familiar compounds is lost. Thus it happens that our common experience of the chemical properties of bodies and elements avails us little indeed in predicting the chemical reactions which will take place above this temperature. So it is that investigation at even this moderately high temperature has become a specialty.

At 2000 deg. C. most all substances known to us will be plastic, gaseous, or molten; and physical properties generally are so profoundly modified that their exact nature is only to be vaguely apprehended. We find, for instance, that all matter conducts electricity, which means that electrical energy must spend itself in eddy currents, for no insulators can be found to confine the electric current in directed paths. As for magnetic effects, all magnetism was left far behind at 800 deg. C.

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The New and Unusual in the Automotive Field

General Electric-Bijur Starting Motors with New Small Pinion Gives Increased Cranking Power—New Toledo Trimming Press Is Probably Largest Ever Built

It will be the policy of Automotive Manufacturer (as in Automotive Engineering) to present on these pages each month some car, truck, aeroplane, boat, tractor, engine or other unit, which presents unusual and decidedly different engineering features

Starting Motors with Small Pinions

Practically all motor cars are equipped with starting systems, now that Ford cars are turned out with this important accessory. So, too, are a large and increasing number of motor trucks, so that the subject of starting motors and other components of the starting system are of great and increasing importance. One of the things which designers have sought for ever since the first starting outfit was perfected is high cranking power. It was early found that the size of the motor and consequently its output were very decidedly limited by the space available, and starting motors reached their maximum size a long time ago.

Of late, however, an investigation of the subject of starting pinions has shown that a smaller size than the previous standard of 11 teeth could be used and that from this use greater starting power would result in just the ratio that the new pinion was smaller. Besides this, as an aftermath of the war and war conditions perhaps, practically all post-war automotive design has conformed very closely to S. A. E. recommended practice. In the illustrations herewith are shown not alone a new device, with the new smaller pinion, but an interpretation of the recently adopted S. A. E. standard sleeve of barrel type of outboard mount. These illustrations show the new Bijur line of starting motors. In Fig. 1 will be noted the characteristic cylindrical shaped housing and hole for the setscrew which is provided for insuring proper location of the starter in relation to the crankcase.

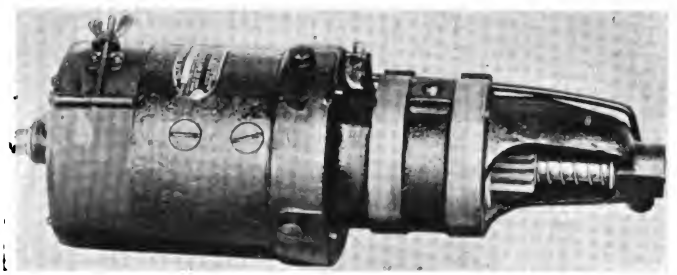

Fig. 1—New Bijur starter with S. A. E. sleeve mount

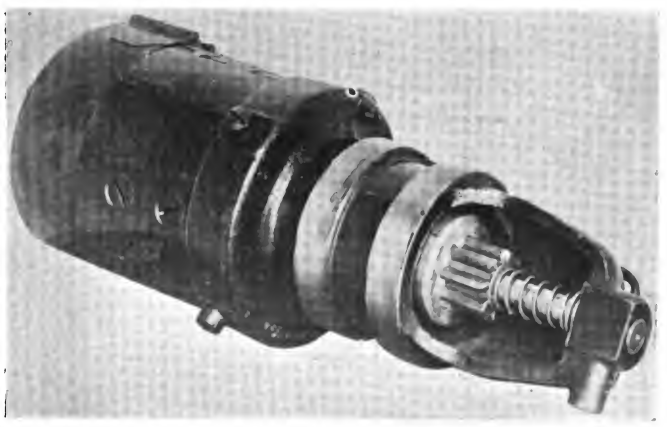

Fig. 2—End view showing new 8-tooth pinion

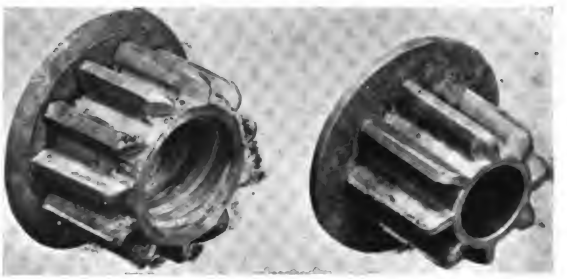

Fig. 3—Screw shift pinions, comparing the 11- and 8-tooth forms

In addition to other refinements, engineers have for the first time incorporated in these motors an 8-tooth meshing pinion which was originally developed for the Bijur aeronautical starter and used during the war on seaplanes and dirigibles with very pleasing results. This is the first instance of the use of an 8-tooth pinion in connection with a starter screw shift. As shown in Fig. 2 this pinion has been incorporated into a standard Bijur barrel type of direct shift, which is unchanged with its characteristic non-jamming and non-hunting features. A slight decentralizing of the armature shaft in respect to the housing takes up the difference in pinion diameter and permits interchanging with starters fitted with 11-tooth pinions, and without alteration of the engine crankcase. Standard forms of pinion teeth are used, to accommodate standard flywheels.

As will be seen from Fig. 3, the use of eight teeth makes an appreciable reduction in the pinion size. The same diameter of armature shaft is used, however, as with the sleeve type of screw shift with 11-teeth pinion. The exact gain effected by the use of this pinion may also be of interest. Assuming the use of a 126-tooth flywheel, a reduction of 11.4 to 1 is obtained with 11 pinion teeth. With 8 teeth this becomes 15.75 to 1, or a gain of 28 per cent.

In other words, a starter with 8-tooth pinion has 28 per cent more cranking power than the same starter with an 11-tooth pinion. Since the cranking torque of a starter is roughly the product of the battery current used and the gear reduction, less current will be used at normal temperature and more stall torque will be available for breaking away the engine when cold.

Mammoth Toledo Straight Column Trimming Press

While any machine tool or piece of shop equipment must have other advantages than bigness, even bigness has its interest. For both reasons, that is because it is an

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advanced tool marking a high water mark in the trimming of large pieces of forged steel, and because incidentally it is probably the largest single crank trimming press ever built, the machine shown in Fig. 4 will be of interest to all shop executives. The machine weighs approximately 185,000 lbs., and embodies in its construction many features which are rather unique on account of the unusual size of the machine and also because of the fact that it is operated by twin gears on the main shaft. The frame is of the massive four-piece steel tie rod construction, which consists of a base, two uprights and a crown held together by four steel tie bolts of large diameter which are heated and shrunk into place. These four rods take the stress. The uprights are extra heavy to withstand any lateral stress which might occur when the slide is unevenly loaded.

Particular attention is called to the design of the outer shearing-off slide which is of a very substantial construction. The slide is operated by an eccentric shaft which extends through the bearing in an auxiliary housing secured to the outside slide housing by steel tie rods.

An improved method of supporting the clutch shaft by means of a specially designed bracket, bolted to the frame, affords compactness and rigidity and does away with outboard bearing allowing a free space all around the press for ready access and for the handling of material. The press is fitted with a power slide elevator. Ample means of lubrication is provided for by forced feed lubricating system which permits the operator to lubricate all of the important bearings from the floor. The press has a stroke of 16 in. and slide flange 68 in. front to back by 40 in. right to left. Area of bed 72 in. front to back by 48 in. right to left. Has a gear ratio of 44:1 and will make seven strokes per minute. It is used for trimming 12-cylinder aeroplane crankshaft forgings and other similar work from hammers as large as 15,000 lbs.

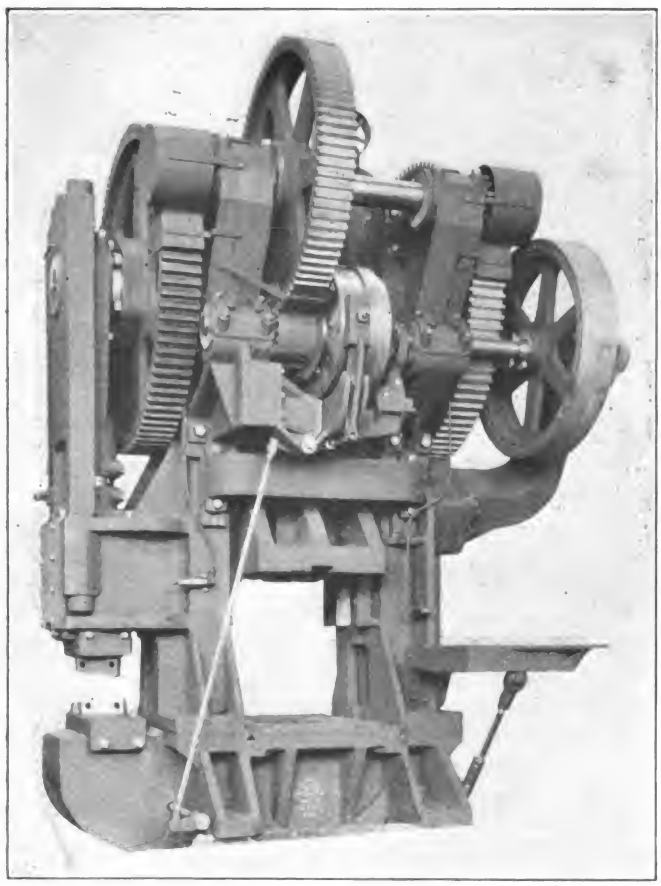

Fig. 4—Rear view of gigantic Toledo trimming press, largest single crank press ever built, having weight of 185,000 lbs. and capacity for work from hammers as large as 15,000 lbs.

Fig. 5—Proving the roundness of a Pedrick piston ring

The Pedrick Piston Ring

A new piston ring for all kinds of internal combustion engines has recently been placed upon the market, this being known as the Pedrick and illustrated in Fig. 5. It is shown in the figure as it is being placed within a cylindrical gauge, this illustrating the exactly round outer surface of the ring, which is a feature, and indicating also that it is of the diagonal split type, that is, the simplest form made.

The particular points claimed for this ring are, besides simplicity and roundness just mentioned, equal pressure on all points, ring does not warp or twist out of shape under heat, no fitting into the cylinder is required, black finish which prevents rusting, remarkably fine grained and even quality of iron.

The rings are machined and finished by hand and are so shaped before finishing that in their final form they will compress to a true circle. The quality of the iron is partly due to the special form in which the ring is cast, and partly to a special heat treatment which each one undergoes. This secret process not alone refines the material and gives it the characteristic black finish, but also the elimination of internal stresses through which elimination the ring exerts the same pressure all around.

The maker states that 98 per cent of piston leakage is past the face of the ring and around the back, so that in a perfect fitting ring which would eliminate all this, the joint loss would be negligible and could be disregarded. These rings are guaranteed to produce more power, save more fuel and more oil and reduce carbon deposits and smoking more than any other ring. If they do this, and the maker will refund the purchase price within six months if they do not, they must be as round and perfect fitting as he claims, as well as having the other desirable qualities.

Our resources in the raw materials of industry and equipment for producing them are greater than any other country.

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Greatly Increased Spanish Benzol Production

Through the medium of recently built plants, Spain is now producing the equivalent of 900,000 gals. a year of benzol (on the basis of 300 gals. equaling one ton), which if mixed with an equal amount of alcohol or other fuel, as benzol seldom, if ever, is used "straight," would mean 1,800,000 gals. of motor vehicle fuel.

Before the war the production of benzol in Spain amounted to 1,150 tons annually, but during the past four years new installations for obtaining benzol have been made, so that in 1918 some 2,000 tons were produced. Two benzol factories just completed will be able, together, to produce 800 tons. Of the present production of benzol 600 tons are taken by the Ministry of Supplies for domestic needs and paid for at a fixed price, the remainder being sold on the market, principally for motor car use. Last November a plant for obtaining benzol from the coke furnaces of Sestao began operations, though its output did not greatly influence the production in 1918; but with this and the other new installations the benzol to be obtained in 1919 will probably amount to 3,000 tons. This quantity is about one-tenth of that required by the automobiles of Spain, and there are projects to increase the production of benzol extensively in this country—Consular Report.

Difference Between Heartwood and Sapwood

In over 300,000 tests which have been made at the Forest Products Laboratory, Madison, Wis., on the various species of wood grown in the United States, no effect upon the mechanical properties of wood due to its change from sapwood into heartwood has ever been noticed. Any difference in the strength of heartwood and sapwood can usually be explained by the growth and density of the wood.

In other than mechanical properties there are differences between heartwood and sapwood which have an important bearing on their use for various purposes. The sapwood of most American species is considerably less resistant to decay than the heartwood, and where the wood is used without preservative treatment in situations which favor decay, the sapwood is likely to have a much shorter life. In these particular cases, therefore, strength requirements may have an indirect bearing on the choice between heartwood and sapwood, inasmuch as wood infected with decay is likely to have its strength properties, particularly that of shock resistance, greatly reduced.

Building Urged to Provide Jobs for Soldiers

The War Department, through Colonel Arthur Woods, is urging state, county and city officials to push work on public buildings in order to provide jobs for returning soldiers and sailors. There has been a gratifying response to this advice, because it is universally felt that the immediate return of ex-service men to suitable employment is of the utmost importance. In commenting on the possibilities of this means of reconstruction, Colonel Woods says:

"Every contract which is let makes more work in the forests, at the mines, in the quarries and at the railroads, in addition to the labor requirements of the operation itself, and this means more jobs for returning soldiers and sailors."

British 1920 Car Output

Recently there appeared in the London Daily Mail an article on British production, which read as follows:

A circular has been forwarded to the Daily Mail from a newly organized British firm of motor car manufacturers, who state that they have decided to go in for mass products and that they have formulated the first year's program of 2,000 light cars priced at £125 ($608). While any new enterprise likely to assist the British motor car industry in stemming the avalanche of competition from abroad which may be expected shortly should be encouraged, the figure of 2,000 cars in the year's output suggests that mass production—that is, the policy of small profits on each car and a large output—is a misunderstood term. A thousand cars a day is the output of several American manufacturers, and in the case of one firm the output is over 2,000 a day. It is recognized that there is a far greater demand for motor cars in the United States, but the demand was to a large extent created by mass production of the cheap car.

Before the war British manufacturers were against mass production because, they said, the demand did not justify it. This scarcely holds good now. An estimate obtained recently from trade experts gave the number of people actually awaiting delivery of motor cars in this country as 200,000. Under present conditions it is difficult to see how this number is going to be supplied without long delay, and delay at the present time offers opportunities to foreign competitors.

Many British firms of repute are taking up mass production, but on inquiry I have not yet found a manufacturer who in 1920 contemplates a greater output than 20,000 cars. It is doubtful if the intended output of all the British firms engaged in mass production exceeds 60,000 cars. In addition to the very large home demand there is a world shortage of motor cars, which would appear to justify the biggest efforts in the matter of output.

N. I. V. A. Convention Goes to Atlantic City

The 1920 convention of the National Implement and Vehicle Association will be held at Atlantic City. Decision to this effect was made by the executive committee of the association at a meeting held in Chicago November 13.

During the recent convention many of the members expressed a preference for Atlantic City and the committee also felt that selection of an eastern city occasionally is due the members of the association who live in that section of the country.

Big Canadian Bushing Company Formed

Wide interest has been shown in this country and aborad in the incorporation of a big, new company entitled International Bushings, Ltd., with an authorized capital of $25,000,000 and headquarters at Toronto. Details as to the interests involved have not been given, but it is understood that the company is closely associated with the Pressed Metals Co., Ltd., which holds important patent rights in various countries in respect to bushings. The new company, it is stated, will take over these rights for all countries outside Canada. The demand for bushings in connection with the motor car industry is stated to be very heavy.

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Germany Short of Aluminum

Before the war the only plant in Germany which produced aluminum was that at Rheinfelden (Baden), a branch of the Swiss Aluminum Industry Co., of Neuhausen, in which both French and German capital is sunk. The Rheinfelden Works only produced about 800 tons a year, which barely provided one-twentieth the quantity required for German industrial needs, the rest being imported from Switzerland, France, and Britain. During the war Germany had great trouble in getting supplies, Switzerland, the sole foreign source open to her, having difficulties in obtaining bauxite. Germany was therefore thrown upon her own resources. In 1915 two aluminum works were erected, one being the Erftwerk at Grevenbroich, on the Rhine. The price of aluminum in Germany is now six times as high as before the war, and is expected to rise higher still.

Owing to the scarcity of small silver coins it is proposed to mint 50 million 50-pfennig coins of aluminum.

The Employment Service of the Department of Labor

Vigorous efforts are made by the Department of Labor to maintain and extend its employment service. The Secretary of the Department asks for an appropriation of $14,000,000 for its maintenance during the coming year. The advantage of a free public employment office over one maintained for private profit is apparent, because it is well known that many evils have crept into the private employment agencies and that they are in many cases parasites on both employer and employe. A federal employment service, however, is also open to criticism under our political system. It lends itself too well to political patronage and it has also been intimated that the service has discriminated between union and nonunion labor. Free federal employment offices must make no such discrimination nor must they differentiate between closed and open shops. If conducted in an absolutely impartial manner and by men who do not hold office because of political patronage, the service would be ideal. Whether it is possible to obtain an employment service so conducted is open to question and on this point more than on any other do the manufacturing industries of the country need assurance before they will be willing to give their support to a bill for the expenditure of $14,000,000 for the federal employment service.

In the 12 months ending September 30, Canada exported more than twice as many automobiles in 1919 as in 1918, the exact figures being: 1918, 7,691 cars valued at $3,461,385, and parts worth $1,276,434; 1919, 17,431 cars valued at $10,414,699, and parts worth $3,436,729. The former figures average $450 per car, which has increased in the latter period to $600, both showing that the majority of the exports were Canadian-built Fords.

Current Automotive Metal and Supply Prices

The coal strike has complicated an already much mixed situation, and the same waiting attitude is still seen among manufacturers. Optimism prevails generally but business men want to see the situation with regard to labor materially improved. The failure of the Senate to pass the Peace Treaty is also causing some uneasiness. Exchange reached new low levels in recent weeks, causing more difficulty in exporting circles and throwing additional business to Germany. General trading is on the increase and bank clearings are at the highest point ever known, despite marked increases in a number of commodities.

General Business

The steel strike is practically won but a new factor, shortage of coal, has entered to prevent any increase in production. The figures have held up very high, approximating 80 per cent of capacity. Even this was not sufficient to meet the demand, and prices have increased, pig iron up $2 a ton, finished and semifinished steel from $1 to $5 a ton. The finished steel market is heavily oversold, and still higher prices can be expected.

Iron and Steel

Not alone has copper continued very quiet, but as we close this issue, the price has just broken under 20 cents for the first time since early in the year, 19½ on November 22 bringing but small sales so that it subsequently declined to 19¼ cents. It is now rumored that copper producers plan to reduce production still further to strengthen the market and lessen their heavy stocks.

Copper

Lead is not active and has not been, but a strong undercurrent continues and the price holds up above 6½ cents (November 24, 6¾c). There is little lead being bought for export, as it is said England and France have adequate stocks. Labor troubles in Australia are said to have reduced the output in the ten months ending with October by 100,000 pounds.

Lead and Antimony

Tin continues in fair demand, and the situation abroad indicates a coming advance in prices. American business continues good. Present price is around 54c. Arrivals to November 20 totaled 2,595 tons. Zinc appears due for an advance, despite the recent firm tone in the market, because there has been a marked advance in London. Prompt New York is quoted at 8.10-8.15 with 8.15-8.25 asked for the first quarter of 1920.

Tin and Zinc

Aluminum is in little demand, virgin 98-99 per cent being quoted at 33 cents in ingots. Little activity is expected in the next few months.

Other Metals The alloy steels are firm and active, as is also spiegeleisen. Foreign inquiry for this material is strong, an Antwerp buyer having inquired about 1,000 tons, and France being in the market for 500 more.

Old Metals Aluminum scrap is no higher, but is very scarce and hard to get. Copper is down in sympathy with virgin metals. Lead and zinc are firm, and tin is scarce and slightly higher.

Heavy chemicals, in fact almost all chemicals, are in fair

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demand. Normally this would mean lower prices, but these days stocks are so small that practically any demand at all keeps prices at a constant level. There are many export inquiries but few orders. Blue vitriol is lower in sympathy with lower copper.

Chemicals

Burlap demand has broadened and business is fair. Prices are being kept firm by small shipments to this country from Calcutta and elsewhere. Both 10½ and 10 oz. 40's are held at 17.75c. Cotton waste is strong, No. 1 white spinners being quoted at 32 to 33.

Fabrics

Spot rubber is steady and unchanged, but all future deliveries are at higher prices. The scrap rubber market is quiet to dull. Leathers have been firm, but small activity has led to the impression that the coming weeks will see a decline; city packer hides are weak, and outside packer hides in small demand. Graphite is unchanged. Shellacs are generally lower, blached bone dry having dropped to $1.20. In recent weeks oils have advanced, Pennsylvania crude being marked up 25 cents a barrel, and all the others in sympathy. Retail lubricating and fuel oil prices are either unchanged or in a few cases lower.

Other Materials

The prevailing prices compared with last month's are as follows. Every effort is made to have these as accurate as possible, but none are guaranteed. Many are obtained through trade sources dealing in large quantities, so these may not be realized on smaller quantities:

	Sept. 20	Nov. 8
Acid, Muriatic, 20° (Hydrochl).lb.	$0.02 — .02½	$0.02 — .02½
Acid, Nitric, 38°.....lb.	.07 — .08½	.07 — .08½
Acid, Sulphuric, 66°.....ton	22.00 —23.00	20.00 —21.00
Alcohol, Wood, 97 p.c.....gal.	1.33 — 1.38	1.33 — 1.38
Alcohol, Denatured .....gal.	.58 — .60†	.58 — .60
Aluminum, Metallic, in Ingots No. 1 99% pure, carload lots.lb.	.32 — .33	.33||
Ammonium Chloride (Sal-Ammoniac) white, lump.....lb.	.13½— .14	.13½— .14
Antimony, Asiatic .....lb.	.08½— .09½	.09¼— .09¾||
Babbitt Metal, best grade.....lb.		
Babbitt Metal, Commercial....lb.		
Beeswax, natural crude, yellow.lb.	.41 — .45	.42 — .44
Benzol, pure .....gal.	.32†	.32
Carnauba No. 1 Wax.....lb.	.86 — .88	.85 — .88
Copper, Lake, ingot.....lb.	.22½	.20||
Copper, Electrolytic .....lb.	.22⅛†	.19¼— .19⅛||
Copper, Casting .....lb.	.22 †	.19||
Graphite, flake, Ceylon.....lb.	.05 — .15§	.05 — .15||
Graphite, Madagascar .....lb.	.10§	.10||
Graphite, Mexican .....ton	32.50§	32.50||
Lead, Pig .....lb.	.06¼†	.06¾||
Lead, Bar .....lb.		
Lead, Red, dry.....lb.	.13	.13
Nickel Metallic Shot and Ingots.lb.	.41 — .45	.41 — .45
Paraffin, ref. 120.....lb.	.07 — .08	.07 — .08
Potash, Caustic (85-92 p. c.)..lb.	.35 — .40	.35 — .40
Pumice, Ground (domestic)....lb.	.02½	.02½
Shellac, TN .....lb.	1.20	1.00
Orange, superfine .....lb.	1.35	1.10 — 1.30
Bleached, bone dry.....lb.	1.40	1.20
Sodium Hydrate (Caustic Soda) 76 p. c.....100 lb.	3.45 — 3.50†	3.45 — 3.50
Solder, half and half.....lb.	.40	
Solder, No. 1.....lb.	.36	
Solder, Refined .....lb.	.31	
Tin, Metallic straights pig....lb.	.55½†	.53½||
Turpentine, spirits of crude.....	1.70†	1.58
Zinc, Western Spelter.....lb.	.08½	.08||
No. 9 base casks, open.....lb.	.12½	

*Oct. 17. †Oct. 14. §Oct. 20. ||Nov. 22.

OLD METALS

Dealers' purchasing prices paid in New York are as follows:

	Oct. 15	Nov. 18
Copper, heavy and crucible.....	22.00	15.00—16.50
Copper, heavy and wire.....	20.00	14.50—16.00
Copper, light and bottoms.....	18.00	13.00—14.00
Brass, heavy	14.50	8.50— 9.50
Brass, light	11.00	6.50— 8.00
Heavy machine composition.....	20.00	.....
No. 1 yellow brass turnings.....	12.75	8.75— 9.25
No. 1 red brass or composition turnings....	16.00	12.50—14.00
Lead, heavy	5.50	5.38— 5.88
Zinc	6.00	4.38— 5.25
Heavy steel scrap, Pittsburgh.....	19.00	23.00
Heavy steel scrap, Philadelphia.....	19.00	20.50
Heavy steel scrap, Chicago.....	17.50	18.00
No. 1 cast, Pittsburgh.....	24.00	28.00
No. 1 cast, Philadelphia.....	25.00	29.00
No. 1 cast, Chicago (net ton).....	23.50	28.50

PIG IRON

Per Gross Ton:	Oct. 14	Nov. 18
No. 2 X, Philadelphia§.....	$32.10	$36.10
No. 2, Valley furnace†.....	26.75	32.00
No. 2, furnace, Chicago*.....	26.75	32.00
Basic, delivered, eastern Pennsylvania.....	28.00	31.25
Basic, Valley furnace.....	25.75	30.00
Bessemer, Pittsburgh	29.35	32.90
Malleable Bessemer, Chicago*.....	27.25	32.50
Malleable, Valley	27.25	32.00
Gray forge, Pittsburgh.....	27.15	32.40
L. S. charcoal, Chicago.....	32.75	37.50

*Average switching charge in the Chicago district is 50c per ton. †Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.

IRON AND SOFT STEEL BARS

Bars.	Oct. 10	Nov. 18
Merchant iron, base price.....	....	....
Refined iron, base price.....	3.37c	3.27c
Burden's H. B. & S. bar iron, base price.....	6.10c	....
Burden's best bar iron, base price.....	6.30c	....
Norway bars, base price.....	20.00c	20.00c
Soft Steel:		
¾ to 1⅞ in., round and square.....	3.37c	3.52c
1 to 6 in. x ⅜ to 1 in.....	3.37c	3.52c
1 to 6 in. x ¼ and 5/16.....	3.47c	3.62c
Rods—⅝ and 11/16.....	3.42c	3.42c
Bands—1½ to 6 x 3/16 to No. 8.....	4.07c	4.22c

BOLTS, NUTS AND RIVETS

	Sept. 25	Nov. 18
Large boiler rivets.....	$4.00	$4.20
¼ in., 5/16 in. and 7/16 in....	% off list	% off list
Machine bolts h.p. nuts, ⅛ x 4 in.:	60-5	50
Smaller and shorter, rolled threads Cut threads	60	50-10
Larger and longer sizes.....	50-10	50
Machine bolts, c.p.c. and t. nuts, ⅛ x 4 in.:	45-5	40-5
Smaller and shorter.....	40-10-5	40-5
Larger and longer.....	40	35-5
Carriage bolts, ⅛ x 6 in.:		
Smaller and shorter, rolled threads	50-10	45-5
Cut threads	50	40-5
Larger and longer sizes.....	40-5	30-10
	per lb. off list	per lb. off list
Hot pressed nuts, sq. blank.....	3.10c	2.50c
Hex., blank	3.10c	2.50c
Sq., tapped	2.85c	2.25c
Hex., tapped	2.85c	2.25c
C.p.c. and t. sq. and hex. nuts, blank	3.10c	2.50c
C.p.c. and t. sq. and hex. nuts, tapped	2.85c	2.25c
Semi-finished hex. nuts:	% off list	% off list
⅜ in. and larger.....	70	65
9/16 in. and smaller.....	75-10	70-10
Tire bolts	60-10	60-10

The above discounts are from lists in effect August 4. All prices carry standard extras.

BRASS AND COPPER SHEETS AND SHAPES

	Oct. 10	Nov. 10
Copper sheets, hot rolled.....lb.	$0.33½	.33½
Copper sheets, cold rolled.....lb.	.35	.35
Copper rods .....lb.	.24	.24¾
Copper wire .....lb.	.26	.26
High brass wire and sheets....lb.	.27¾	.27¾
High brass rods.....lb.	.26¾	.26¾
Low brass wire and sheets....lb.	.30½	.30½
Low brass rods.....lb.	.31¼	.31¼
Brazed brass tubing.....lb.	.39	.39
Brazed bronze tubing.....lb.	.44½	.44¼
Seamless copper tubing.....lb.	.37½	.37½
Seamless bronze tubing.....lb.	.40	.44¼
Seamless brass tubing.....lb.	.36	.36

FERROALLOYS

	Oct. 20	Nov. 20
Ferromanganese, 80% delivered producers' price	$110.00	$110.00
Ferromanganese, 80%, English c.i.f. Atlantic ports.....	100.00 to 105.00	nominal
Spiegel, 18% to 22% furnace, spot	34.00 to 35.00	33.00 to 35.00
Ferrosilicon, 50%, spot and contract, delivered	80.00 to 85.00	80.00 to 85.00
Ferrotungsten, standard, per lb. contained, furnace	1.25 to 1.30	1.10 to 1.20
Ferrochrome, 60% to 70% chromium, 6% to 8% carbon, per lb. contained, maker's plant..	22 to 24 cents	27 to 29 cents
Ferrovanadium, 35% to 40% per lb. contained, according to analysis	$6.00 to $7.50	$5.50 to $7.00

Ferrosilicon prices at Ashland, Ky., Jackson and New Straitsville, O.

CRUDE RUBBER

	Oct. 15	Nov. 15
Para, Upriver fine.....lb.	$0.52 —$0.52½	$0.52 —$0.52½
Upriver coarse .....lb.	.31 — .32¼	.35 — ....
Upriver caucho ball.....lb.	.32 — .32½	.35 — .35½
Plantation, first latex crepe...lb.	.49½— .50	.53 — .54
Ribbed smoked sheets.....lb.	.48½— .49	.52 — .53
Brown crepe, thin, clean....lb.	.43½— .44	.45½— ....
Amber crepe No. 1.....lb.	.47 — .48	.48½— ....

PETROLEUM PRODUCTS

	Oct. 20	Nov. 24
Oil—Pennsylvania Crude	$4.25	$4.50
North Lima Crude.....	2.48	2.73
Kansas and Oklahoma Crude.....	2.25	2.50
Healdton, Crude	1.20	1.35
Ref. 150 Test, Dealers.....	.22	.22
Tanks, wagon to store.....	.16	.16
Fuel, 28-31 deg.....	.14	.14
Gasoline, Motor, garages, steel bbls.....	.24½	.24½
Consumers, steel bbls.....	.26½	.26½
Lubricating Oil, black, 29 gravity.....	.25—.30	.20—.22
Cyl. light filtered.....	.44—.45	.45—.50
Dark filtered	.40—.41	.42—.48
Extra cold test.....	.50—.54	.55—.60
Dark, steam ref.....	.30—.34	.34—.36

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Men of the Automotive Industry

Who They Are What They Are What They Are Doing

George H. McDade recently became affiliated with the Pratt & Whitney Co., Hartford, Conn., maker of machine tools and small tools, etc., in its main office. He has had a wide experience as a shop executive, with the Allentown (Pa.) Foundry & Machine Co., and the Allentown Wire Co. Later he was chief inspector for the Bethlehem Steel Co., and superintendent of the crane department for the Niles, Bement, Pond Co., from 1901 until 1906. Special work for the Westinghouse Electric & Mfg. Co. took up the next four years and he then became superintendent of the automobile department of the Flint Wagon Works; master mechanic of the engine department of the Buick Motor Co.; engine shop superintendent with the Hudson Motor Car Co., Detroit; factory manager with the Northway Motor & Mfg. Co., that city, and then back to Flint, Mich., to do some special work for the Buick company.

C. W. Curtiss has resigned his position as director and general manager of the Splitdorf Electrical Co., to take charge of the affairs of a large automobile accessory company, whose headquarters will be located in Newark, N. J. The company with which Mr. Curtiss is to become identified will proceed with the erection of a large plant to take care of the expansion of a business of tremendous proportions and of far reaching import to the automotive industry.

Albert H. Zimmerman, who for 14 years has been affiliated with the Continental Motor Co., Detroit, recently was made vice-president, treasurer and general manager of the Supreme Motors Co., Warren, O. Mr. Zimmerman is 36 years old and began his business career as auditor and factory accountant for the Continental company. At that time the factory output was about 100 motors annually and this since has grown to 160,000.

C. Y. Kenworthy, formerly eastern representative for the Rausch & Lang line, and more recently vice-president of the Roamer Motor Car Co., of Illinois, and Chicago representative of the Barley Motor Car Co., builder of Roamer cars, is preparing to produce the Kenworthy car at Mishawaka, Ind., home of the Dodge Mfg. Co., the president of which, Melville W. Mix, is understood to be interested in the Kenworthy company.

Fenton J. Spaulding, well known to the automotive trade through his long connection with tractor chain production, is the head of a new steel roller chain industry organized at Bloomfield, N. J., under the name of Spaulding Chain Co., Inc. Mr. Spaulding is president of the corporation. Associated with him are Homer L. Worbois as chief engineer and John T. Hyde as superintendent.

Harry C. Stutz, who recently resigned from the company bearing his name, will reenter the industry with a moderate sized quality car, to be called the H. C. S., and which will be ready for the National shows. He is president of the new concern and has associated with him Henry F. Campbell as treasurer. Mr. Campbell was formerly treasurer of the Stutz company.

H. A. Fitz John, former production manager Continental Motors Corp., Muskegon, and during the war director of purchases and in charge of production at Dayton Wright Airplane Co., Dayton, O., has embarked in the manufacture of truck bodies at Muskegon, having formed the Fitz John-Erwin Mfg. Co., of which he is president, for this purpose.

Otis C. Friend, formerly president of the Mitchell Motors Co., and later vice-president of the United Motors Co., is the reported buyer of a controlling interest in the Olympian Motor Co., which occupies the old Cartercar plant at Pontiac, and has been looked upon as a possible subject for development to proportions of considerable magnitude.

F. M. White, who has been in charge of the farm power bureau of the Emerson-Brantingham Implement Co., Rockford, Ill., during the past year, has been promoted to assistant general sales manager. Turner Barger, who has been assistant in the extension division, has been appointed assistant manager of the farm power bureau.

Harry E. Figgie recently became sales manager for the Perfection Spring division of the Standard Parts Co., Cleveland, succeeding W. P. Culver, resigned. For the past few years he has been sales manager at that plant, prior to which he was assistant superintendent.

Clifton Eugene Barnes has been appointed research graduate assistant in gas engineering for the college of engineering in the University of Illinois. He graduated from the Universty of Illinois in 1919 with the degree of Bachelor of Science in chemical engineering.

S. W. C. Fitts, for the past two years superintendent of the Worcester (Mass.) Stamped Metal Co., has resigned to accept a similar position in Los Angeles. He is succeeded by Victor Carlstrom, who comes from the Wire Wheel Co. of America, Buffalo.

F. F. Coutts has resigned his position as general foundry foreman for the Midwest Engine Co., Indianapolis, and has been made foundry superintendent for the Fulton Iron & Machine Co., St. Louis, maker of Diesel engines and cane crushing machinery.

Harvey Woolsey Hyde has been appointed research graduate assistant in gas engineering for the college of engineering for the University of Illinois. He will receive his degere of Bachelor of Science in chemistry from the university in October.

Earl E. Eby, formerly sales manager for the Hyatt Roller Bearing Co., industrial bearings division, New York, has been appointed to the board of directors of Hyatt, Ltd., New York, a new company formed to market the Hyatt bearing in Europe.

J. E. Nield, assistant general manager of the Trego Motors Co., has resigned to become associated in the manufacturing department of the Buffalo Body Corp. In addition to his duty in this department, he will also have charge of purchases.

Walter W. Smith, secretary and treasurer of the O. J. Beaudette Co., body manufacturer, Pontiac, Mich., has resigned. He retains his interest in the company, however, and his seat on the board of directors. He will spend the winter in California.

George Peacock, since 1912 superintendent of the Tudhope Anderson factory at Orilla, Ont., has severed his connection with that concern and is now factory manager of the Oldsmobile plant at Oshawa, owned by General Motors of Canada.

Walter Brown has severed his connection with the Webster Electric Co., Racine, Wis. The position of general manager, which he has held for a number of years, is temporarily in the hands of S. A. Loeb, secretary and treasurer.

John T. Spicer has been appointed general sales manager of the Thermoid Rubber Co., Trenton, N. J. Spicer has been connected with the company in the capacity of advertising manager, and his promotion is effective immediately.

Lee J. Eastman has been made president and general manager of the Packard Motor Car Co. of New York. He succeeds Roger J. Gilmore, resigned. He will make his headquarters at the Packard Building in New York City.

Howard R. Bemis, president and treasurer of the Bemis & Call Hardware and Tool Co., Springfield, Mass., has been elected a director of the Hendee Mfg. Co. of that city in place of C. O. Hedstrom, resigned.

Harry Shaw has resigned as purchasing manager of the Hendee Mfg. Co., Springfield, Mass., to become treasurer and general manager of the Stoy Rubber Corp., Hempstead, L. I.

John W. Maguire, formerly vice-president of the Brunswick-Balke-Collender Co., Chicago, is now vice-president and general manager of the Portage Rubber Co., Barberton, O.

George Peacock, since 1912 superintendent of the Tudhope-Anderson factory, Orilla, Ont., has left for Oshawa, where he will be manager of the Oldsmobile factory.

Charles H. Schmalz who recently resigned from the Hanna Engineering Works, Chicago, has become assistant factory manager of the Holt Mfg. Co., Peoria, Ill.

T. B. Tomkinson has been appointed assistant to the comptroller of the B. F. Goodrich Co. Prior to this he was assistant auditor for the past four years.

Elihu M. Harriger has accepted a position as foundry foreman with the Gilmore Marine Motor Co., iron, brass and aluminum foundry, Detroit.

D. R. Scholes resigned recently as second vice-president of the Illinois Malleable Iron Co., Chicago, to become connected with the Aeromotor Co.

R. W. Sutherland has been elected general manager the Splitdorf Electrical Co., Newark, N. J., succeeding C. W. Curtiss resigned.

F. C. Manning is now vice-president and factory sales manager the Splitdorf Electrical Co., Newark, N. J.

George D. Smith has been appointed assistant to the president Winther Motor Truck Co., Kenosha, Wis.

OBITUARY

Charles N. McFarland, general manager Jaxon Steel Products Division, General Motors Corp., died at Jackson, Mich., November 1, following an operation for appendicitis.

Additional Notes of Parts Makers

Bethlehem Spark Plug Corp., Bethlehem, Pa., formerly the Silvex Co., is planning for plant additions for increased capacity. The first will be a porcelain and machining works, to cost with equipment about $500,000. E. H. Schwab is president.

Walker Mfg. Co., Racine, Wis., manufacturer of automotive equipment, has awarded contract for the erection and equipment of a brick and steel foundry, 80 x 120 ft. The Walker company specializes in lifting jacks.

Pittsburgh Model Engine Co., Homewood, near Pittsburgh, is planning for the rebuilding of its pattern shop and other buildings, recently destroyed by fire, with loss reported in excess of $100,000.

Stouts Mfg. Co., Lockport, N. Y., has been incorporated with a capital stock of $300,000 by H. W. Lowell, E. H. Huber and L. F. Stout, to manufacture automobile parts and devices.

Fitzgerald Mfg. Co., Torrington, Conn., manufacturer of automobile horns, gaskets, etc., is planning for the erection of an addition to its plant on Boyd street, Winsted, Conn.

Standard Equipment Co., Lorain avenue and West 106th street, Cleveland, maker of automobile parts, is planning the erection of a two-story addition, 75 x 100 ft.

Inland Machine Co., 1629 Locust street, St. Louis, is taking bids for its proposed two-story plant at Garrison and North Market streets, to cost about $100,000.

Busch-Sulzer Bros. Diesel Engine Co., St. Louis, is about to build an addition comprising a one-story building at Second and Utah streets, to cost $30,000.

Jamestown (N. Y.) Parts Co., manufacturer of automobile parts, will erect a one-story building to cost about $10,000.

Automobile Equipment Co., Blackstone Building, Cleveland, has placed contract for a two-story addition 65 x 100 ft.

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Activities of Automotive Manufacturers

Where They Are Located What They Are Doing How They Are Prospering

E. A. Nelson Motor Car Co. and the **Gray Motor Co.**, Detroit, have consolidated and will manufacture the present Nelson car on a greatly enlarged scale. The Nelson company was organized in 1917, while the Gray company has been in business since 1905. The new concern will be known as the Nelson Motor Car Co. The capital stock of the company has been increased to $2,000,000 and shortly will be increased again to $3,000,000, of which $1,000,000 will be 8 per cent preferred and $2,000,000 common. Officers of the Gray Motor Car Co., headed by D. J. Mulford, the president, will retire. The new company will be managed by the present Nelson personnel, which includes E. A. Nelson, president; C. H. Dunlap, vice-president; C. F. Harvey, treasurer; G. C. Aldrich, secretary. For the present both plants will be operated, but in course of time the Nelson equipment will be moved into the Gray plant and future work carried on there.

Willys Corp., New York, has been formed to take over the Autolite Corp., Toledo, O.; New Process Gear Corp., Syracuse, N. Y., and Duesenberg Motors Corp., New York and Elizabeth, N. J. John Willys is head of the new concern but active operations will be in the hands of J. R. Harbeck, who has been vice-president American Can Co. A new light-six car will be turned out in large quantities, will sell at a low pirce and embody many new features. The Duesenberg plants at Elizabeth and Poughkeepsie, N. Y. (the former Fiat plant) are being enlarged and equipped with machinery for the big production, said to be 600 a day, after January 1. The structures will include a one- and two-story shop building, 50 x 900 ft.; four-story and basement addition, 320 x 400 ft.; power plant and a four-story reinforced concrete assembling works, 120 x 440 ft.

Skelton Motor Corp., recently incorporated by Dr. L. S. Skelton, of Kansas City, Mo., has contracted with the St. Louis Car Co. to produce 20,000 automobiles. They will be part manufactured and part assembled, but the intention is to manufacture all the parts ultimately. According to E. B. Meissner, vice-president and general manager of the car company, 800 men will be added to the present working force of 1,200, and cars will be turned out at the rate of 50 per day very shortly. The machine will be a light four-cylinder type of moderate price. Dr. Skelton is said to have purchased also a controlling interest in the Premier Motor Car Corp., Indianapolis, and plans to continue the manufacture of that car.

Antigo Tractor Co., recently formed at Antigo, Wis., has completed its organization and elected the following officers: President, Chas. W. Fish, of the Fish Lumber Co.; vice-president, L. P. Tradewell, of the Morse-Tradewell Co.; treasurer, Ernest Hirt, of Hirt Bros. Milling Co.; secretary, E. A. Yahr, formerly of the contracting company of Farnum & Yahr. The board of directors consists of the above and John Manse, P. J. McQuillan, Edw. Faust and D. S. Stewart. The latter is the designer of the tractor to be manufactured.

Steam Automotive Works, Denver, is successor to the Steam Auto Co. It is under the management of a board of trustees with J. H. Stokesbary president of the board; C. C. McFee, secretary, and M. E. Johnson, treasurer. The new company will feature a five-ton truck and later will bring out passenger cars, coaches and farm tractors, all with a steam power plant. This unit has a number of special features. A factory site has been obtained and a new plant with 200,000 sq. ft. of floor space is being planned.

Antigo Tractor Co., Antigo, Wis., has been organized with a capital stock of $500,000 to manufacture tractors, gas engines, etc. It plans to place in production as soon as a factory can be equipped a new design of farm and general haulage machine developed by D. S. Stewart, of Oshkosh, Wis. Plans are being prepared for a one-story brick and steel machine shop, 100 x 200 ft., to be erected early next spring. Equipment is now being purchased. E. A. Yahr is secretary.

Stevens-Duryea Co., Chicopee, Mass., is reported as having bought nearly $100,000 worth of machinery from the New England Westinghouse Co. and is installing it in the old Stevens-Duryea plant, to be known as the repair shop. The company also is reported as in the market for a large amount of equipment for its new plant, but that actual purchases have been held up pending the selection of a purchasing agent. Purchases will be made through New York.

General Motors Truck Co., now located at Pontiac, Mich., according to report will soon be established in a new plant in Detroit, where a factory 360 x 1,800 ft. will be erected on Holbrook avenue near Oakland avenue, on property purchased by General Motors Corp. in 1915. The new works will be two stories high and will give about 1,300,000 sq. ft. Plans have been accepted and ground will be broken soon.

Ohio Trailer Co., Cleveland, has changed its name to Ohio Motor Vehicle Co. and increased its stock to $1,000,000. In addition to trailers, a high class six-cylinder passenger will be built and a definite production schedule for 1,000 cars in eight months of 1920 has been laid down and materials and parts bought on that basis. The management is unchanged.

Pacific Auto-Rail Car Co., Sacramento, Cal., has bought the Meister plant and eight more acres on the 12th street road, where the largest automobile manufacturing plant west of St. Louis will be erected. A. R. Meister is general manager, and S. D. Rogers, the inventor of the car, second vice-president and chief engineer.

White Motor Co., Cleveland, is doing so much business and expanding so rapidly that additional capital is necessary, and it is planned to increase the capital stock from $20,000,000 to $25,000,000. The additional stock will be offered to present stockholders at par on the basis of one share for every four of the old held.

Cadillac Motor Car Co., Detroit, will erect a branch assembling plant and distributing house in Milwaukee, at North avenue and Bartlett street, costing $225,000. Kirchhoff & Rose, architects, Majestic Building, are taking bids for a three-story brick, steel and reinforced concrete building, 121 x 250 ft.

General Motors Co. will shortly establish a big plant in Nashville, Tenn., according to rumors from that town, either through the purchase of the government's big powder plant for which an offer has been made, or through the building of an enormous entirely new plant.

Premier Motor Corp., Indianapolis, is undergoing reorganization, following the recent sale of a controlling interest to an Oklahoma capitalist. Plans have been made for large material storage and other buildings, and an output for 1920 of 3,000 cars is expected.

Ahrens-Fox Fire Engine Co., Cincinnati, has acquired additional property adjoining its plant, providing 200,000 sq. ft. of floor space. They include five buildings, involving an expenditure of approximately $700,000 for the structures and $300,000 for equipment.

Lenhart Motor Truck Co., Minneapolis, Minn., recently incorporated by F. F. and R. F. Lenhart and E. L. and F. A. Leicher, with a capital of $250,000, will manufacture a line of trucks ranging from 1½ to 3 tons and from $1,650 to $2,500 in price.

Ford Motor Co., Detroit, have assets totalling practically $300,000,000, according to the annual report for the year ending July 31 recently filed with the secretary of state. In this no valuation is placed on the good will, patents, formulas, etc.

Winther Motor Co., Kenosha, Wis., is planning to move to Milwaukee and has secured options on a large tract of land near the Nash Motors new plant, Clement avenue, where more than $500,000 will be spent for buildings and equipment.

Gulf States Tractor Co., New Orleans, La., with a capital of $6,000,000, has purchased a foundry which it will enlarge for the manufacture of four-wheel drive motor tractors. W. E. McCorquodale, Orange, Tex., is president.

Kansas City (Mo.) Truck Co. has been incorporated in Delaware with capital of $1,000,000 by Theodore Ditmas, Thomas A. Ferguson and Charles B. Day, all of Kansas City, to manufacture gasoline motor trucks and tractors.

Ford Motor Co. of Canada, Ltd., has purchased the properties of the Dominion Stamping Co., Ford, Ont., for $750,000. The manufacture of fenders and other automobile accessories will be continued by the Ford company.

Curtiss Motor Co., Little Rock, Ark., capitalized at $2,000,000, will soon begin to turn out automotive vehicles. The company's products will include four- and six-cylinder Curtiss automobiles, also trucks and tractors.

Republic Motor Truck Co., Alma, Mich., has passed into the hands of the Willys interests, headed by John N. Willys, Toledo, according to a statement by Charles G. Rhodes, secretary and treasurer of the Republic company.

Packard Motor Car Co., Detroit, has purchased 4 8/10 acres at the northwest corner of Princeton avenue and West 37th street, Chicago, as the site of a two-story assembling plant, 300 x 390 ft., to cost $350,000.

Highway Trailer Co., Edgerton, Wis., has broken ground for a brick shop addition, 160 x 510 ft., of which 30 x 160 ft. will be two stories and the remainder one story. James W. Menhall is general manager.

Wright Aeronautical Corp., New York, has been incorporated with an active capital of $1,250,000 by T. L. Chadbourne, F. B. Adams and J. B. Clews, 15 Broad street, to manufacture aircraft.

Mackey Truck & Tractor Co., having a capital stock of $250,000, contemplates establishing a plant in Ravenna, O., for building motor trucks. A structure 60 x 160 ft. will be erected.

Acme Motor Truck Co., Cadillac, Mich., has begun construction on the first of four new units, which will double the capacity of the plant. The new building will be 65 x 144 ft.

Mackey Truck & Tractor Co. has been organized at Ravenna, O., with a capital stock of $250,000. The company expects to build motor trucks and later may add tractors.

Laidlaw Dearborn Truck Co., Peoria, Ill., has been incorporated by F., W. A. and W. F. Laidlaw and A. J. Thieme to assemble trucks, using standard units throughout.

Ursus Motor Co., 6601 Grand avenue, Chicago, will erect a one- and two-story motor truck plant, 120 x 150 ft., at Grand and Fullerton avenues, to cost $50,000.

Magnet Tractor Co. has been incorporated in Minneapolis with authorized capital stock of $500,000. The incorporators are S. A. Jacobson and Einar Hoidale.

H. H. Franklin Mfg. Co., Syracuse, N. Y., manufacturer of automobiles and special machinery, has increased its capital from $2,600,000 to $7,000,000.

Bollstrom Motors Co., St. Louis, Mich., a new concern which will make a four-drive truck, is working on a new factory one story, 60 x 304 ft.

Dort Motor Car Co., Flint, Mich., has increased its capital from $2,000,000 to $3,500,000 and will soon announce a program of large expansions.

Six-Wheel Truck Co., Fox Lake, Wis., has been incorporated with $60,000 capital to manufacture a new combination truck and trailer.

Oshkosh (Wis.) Motor Truck Co. has increased its facilities and will have an output for 1920 increased to 500 four-wheel drive trucks.

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National Automobile Chamber of Commerce service managers meeting will be held at Hotel Statler, Detroit, November 10 to 12.

Metz Co., Waltham, Mass., manufacturer of pleasure automobiles, is reported in the market for machine tool equipment.

Megow Tractor Co., Holly, Mich., which is now in course of organization, plans also to manufacture tools and dies.

Commerce Motor Car Co., Detroit, has increased its capital stock from $400,000 to $700,000.

Erie (Pa.) Motor Truck Mfg. Co. has increased its capital stock from $50,000 to $175,000.

Parts Makers

Radel Leather Mfg. Co., Wilson avenue, Newark, N. J., specializing in the production of leathers for automobile, carriage, and other service, has completed plans for the constructon of another large addition to its plant, making the third complete tannery unit to be erected at this plant during the present year. The new building will be two story, of reinforced concrete and mill construction, of a size 85 x 125 ft.; it will be equipped as a beam house, tan yard, and for other features of tannery service. The installation will include a series of modern concrete vats with overhead conveyor system for the handling of hides. The new building, with proposed machinery and equipment, is estimated to cost about $150,000.

Duratex Co., Newark, N. J., manufacturer of artificial leather, has arranged for the erection of a series of new buildings at its plant, to provide for increased capacity. The main structure will be one story, about 100 x 500 ft., while the other structures will comprise one-story laboratory building, one-story extension to power plant, additional storage facilities, as well as other auxiliary structures. The entire work is estimated to cost approximately $500,000.

Leather Parts Co. has been formed in Indianapolis for the purpose of manufacturing leather parts and leather specialties of all kinds for tractors, trucks and automobiles. It has taken over the business formerly conducted under the name of Otto Bunge Co. The officers of the Leather Parts Co. are as follows: President, A. H. Olds; vice-president, Otto Bunge; secretary-treasurer, A. M. Fodrea; sales manager, C. H. Nigh. Mr. Olds is secretary of the Hide, Leather & Belting Co., and Mr. Fodrea for a number of years was head salesman of that company.

Edward V. Hartford, Inc., 141 Morgan street, Jersey City, N. J., manufacturer of shock absorbers, etc., will remove its present plant about November 1 to the former works of the Standard Ordnance Co., West Side avenue and Carbon place, Jersey City, and increase its present output. The eight-story building now occupied by the company has been leased by the Brunswick-Balke-Collender Co., Chicago, manufacturer of automobile tires, talking machines, refrigerators, etc., which will occupy it.

Minerva Engine Co., Cleveland, builder of engines for tractors and motor trucks, has purchased an eight-acre site on Dunham road on which it will erect a plant. Contracts will be awarded shortly for the first unit which will provide 30,000 sq. ft. of floor space, to be used for a machine shop and assembling and testing departments. The erection of a gray iron foundry is contemplated. C. S. Goby is president and D. R. Long secretary.

A. O. Smith Corp., Milwaukee, manufacturer of pressed steel, forged and stamped automotive parts, expects to begin work about November 15 on the second unit of its $3,500,000 improvement project. The second shop will be 360 x 850 ft., two stories, with a section six stories. The estimated cost is $1,200,000, including machinery. The first unit was undertaken October 10 and will be 175 x 740 ft.

General Leather Co., Newark, N. J., has had plans prepared for a large addition to its plant to form a complete new unit. This will be four story and part one story high, varying in width from 75 to 130 ft. and the length 721 ft. The one story part will be used as a hide house, beam house and tan yard, the first floor of the four story part for retanning, and the balance for various finishing processes.

Standard Steel & Bearings, Inc., is the name of the corporation formed to take over the consolidation of Martin-Rockwell Corp., New Haven, Conn.; Standard Roller Bearing Co., Philadelphia; Braeburn Steel Co., Pittsburgh; Rockwell-Drake Co., Plainville, Conn.; Rockwell-Drake Co., New Haven; Rockwell-Drake Co., Norwich, Conn., and Mayo Radiator Co., New Haven.

Arthur H. Dittmer, 8 Harvey avenue, Lockport, N. Y., formerly director of production and purchases of the Covert Gear Co., has purchased the former plant of the Mansfield Glass Co. at Green and Grand streets, New York Central and Erie railroads, and has organized a company capitalized at $150,000, which will erect a plant for the manufacture of gears for automobiles.

Continental Motors Co., Muskegon, Mich., plant additions will be completed by December 1, making it possible to increase the working force by several hundred men. The present assembling building is 180 x 650 ft. To this an extension is being made 490 ft. long. Another addition is a steam plant, which will be the first unit of a 20,000 kw. power station.

Spirex Radiator Co., Racine, Wis., manufacturing radiators for motor vehicles and tractors, has acquired the business of the M. Jenson Co., sheet metal products, 1325 Sixteenth street, Racine, and has consolidated the operation in its plant at Fourth street and Lake avenue. M. Jenson and Joseph Laursen are associated with the new owner as departmental superintendents.

Lewis Steel Products Co., Toledo, O., has awarded contract for the erection of a foundry and machine shop addition, embracing also an office building, 150 x 360 ft., and to cost about $250,000 with equipment. Angelo R. Clas, formerly of Milwaukee and Sheboygan Falls, Wis., is president and general manager.

Ajax Auto Parts Co., Racine, Wis., has awarded contracts for the erection of a one-story brick and steel shop addition, 64 x 130 ft., and has plans under way for a three-story brick and mill factory and warehouse, 85 x 120 ft., at Fifteenth street and the Chicago & Northwestern tracks. J. W. Bate is president.

Standard Wheel Co., Terre Haute, Ind., control is said to have passed to Carl D. Fischer, previous owner of one-third and president and general manager for the past 10 years. This firm is said to be the largest manufacturer of automobile wheels in the country, and was founded almost half a century ago.

Lewis Steel Products Co., Toledo, has commenced the erection of a new plant on lower Summit street, consisting of a foundry and machine shop, each 80 x 300 ft., and an office building. The present works will be abandoned when the new one is ready for operation. It will be used for the manufacture of valves.

Sewell Cushion Wheel Co., Detroit, has purchased a new factory site of ten acres on Harper avenue at the junction of the Terminal Railroad. The company plans to start in the near future to erect a new factory on this site that will, when completed, increase its production of the truck wheels 200 per cent.

J. W. Murray Mfg. Co., Detroit, which recently announced it would establish a plant in Cleveland, has acquired 40,000 sq. ft. of floor space in a building at Grant avenue, S.E., and the Nickel Plate Railroad, which will be equipped for the manufacture of sheet metal parts used in the automobile field.

Middletown Rubber Co., Inc., has been organized by Chicago and Cleveland tire jobbers and will erect a modern plant at Middletown, N. Y. The company is capitalized at $1,000,000 and was formed to manufacture cord tires, inner tubes and other rubber products to supply the firms interested in it.

Wheeler-Schebler Carbureter Co. has acquired additional ground at Sanders street and Barth avenue, Indianapolis, where three factory buildings will be erected at a cost of about $100,000. The main building will be 108 x 132 ft. Two smaller structures will be used for testing motors.

American Swiss Magneto Co., capitalized at $100,000, will move its plant from Monroe, Mich., to Toledo, for the manufacture of magnetos for the automotive industry. J. B. Nordholdt, W. W. Knight, H. L. Thompson are the incorporators and J. A. Bohannon manager of the plant.

New Departure Mfg. Co., Bristol, Conn., manufacturer of bearings, steel balls, etc., has acquired an existing building at Meriden, Conn., with adjoining site, for the establishment of a branch plant. The present structure will be remodeled and two new factory buildings will be erected.

Body Builders

Seaman Body Corp., Milwaukee, Wis., has been incorporated with a capital stock of $200,000 as a development of the business of the W. S. Seaman Co., 480 Virginia street, which is one of the largest builders of fine motor vehicle bodies in the middle west. The concern was founded in 1910 and now operates two large factories in Milwaukee. Harold and Irving Seaman continue as principal officers and general managers under the reincorporation, which was made for the purpose of extensive enlargement of facilities and trade.

C. R. Wilson Body Co. has started construction work involving about $1,000,000. The new six-story press department is about completed and work has started on another six-story concrete and steel plant adjoining it, which will give approximately 100,000 additional sq. ft. at a cost of $250,000. Work has been started on an additional unit of the Bay City plant, 100 x 300 ft. Work on the new power house is progressing, and a big plant is being erected on the site of the building destroyed by fire last February.

Ford Motor Co. is to erect a body building plant on the River Rouge, near Detroit, which will have a producing capacity of 1,500 bodies daily and provide employment for between 10,000 and 15,000 men, according to announcement by F. J. Hadas, general superintendent of the body plant. "We have set a mark of 1,000,000 automobiles this year," he said, "and unless the unforseen happens we will do it."

Robbins Body Corp., Indianapolis, with $2,500,000 capital, will occupy besides the present factory, a new building with 500,000 feet of floor space, will employ 1,000, and will build only enclosed bodies. There is a marked shortage of enclosed body, due to the rapidly increasing public demand for this form, and the company have about $10,000,000 business in sight for the first year, all unsolicited.

James & Graham Wagon Co., Memphis, Tenn., one of the oldest concerns in that city, has been reorganized, with considerable new capital, and a better site for a large plant will be selected shortly. On this a new and modern factory with new and up-to-date equipment will be built. W. E. Henderson, secretary of the old concern, will be president of the new one.

Fitz John-Erwin Mfg. Co., Muskegon, Mich., has been organized with a capital of $100,000 to build truck bodies and cabs which will be sold direct to truck manufacturers. An eight-acre tract has been purchased and the initial building with 25,000 sq. ft. completed. H. A. Fitz John is president and general manager. L. B. Erwin, secretary.

J. L. Clark Mfg. Co., Oshkosh, Wis., is remodeling its carriage and vehicle factory and installing new equipment for manufacturing automobile and motor truck bodies, cabs, etc. The officers are: President, H. M. Clark; vice-president, E. M. Clark; secretary and treasurer, W. E. Muir.

Pullman Co., Chicago, manufacturer of railroad cars, is arranging for an extension of operations and is equipping one of its buildings for the manufacture of automobile bodies. The company has received an order from the Packard Motor Car Co., Detroit, for 4,000 car bodies.

Nu-Way Wagon Box Co., Kewanee, Ill., is considering the erection of a branch factory to cost $60,000, at Wyoming, Ill. The company manufactures truck bodies, as well as a convertible wagon box, farm gates, etc.

Brown Body Corp. has been incorporated in Delaware with $2,000,000 capital to manufacture automotive bodies and parts.

Automotive Body Corp., Chicago, has been incorporated with $25,000 to build bodies, by W. B., B. H. and S. H. Levey.

Mullins Body Corp., Salem, O., plans to erect extensions which will include a plant to make automobile bodies.

Watkins Body Corp., 673 Genesee street, Buffalo, will build a brick addition to its factory to cost $18,000.

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French Industrial Conditions Demand Cars and Tractors

In reconstruction work in France, which now has made a good start, the automobile and tractor are to play a very large part, much larger than before the war. The automobile, in fact, is to have practically a new lease of life, for all the former manufacturers have now very large plants which during hostilities were used for war material, and which turned back to trucks and passenger cars will make for very much greater production.

Berliet is to make a car selling for $2,500, while Renault is to manufacture a $1,500 car which will be complete with all equipment. Andre Citroen, originator of the herringbone gear, started in 1914 in a very modest way to make shells, his original contract being for 50,000. Eventually the production reached 50,000 per day, and in addition they made fuses, forgings and other products, employing some 16,000 people. Now this plant is to produce a four-cylinder car selling for $1,600. Their schedule calls for 100 per day, and they claim to have sold 20,000 of the first year's production of 30,000.

A number of tractors will be made in France. Practically all farm horses have been killed in the north. Some tractors have been imported, but in March further importation was prohibited indefinitely. This prohibition undoubtedly will be withdrawn later, but meanwhile agriculture is held up to some extent. The government has arranged to finance the purchase of tractors for groups of farmers in the invaded districts.

Schneider & Co., before the war, had only two plants. Now they own 25 or 30, manufacturing locomotives, tractors, gas and oil engines, etc. They have not announced their future plans. Very few companies have made such announcements and it is impossible to learn what they intend to do.

Varnish Does Not Prevent Moisture Absorption

In experiments made by the Forest Products Laboratory it was found that varnishes do not entirely prevent the transmission of moisture into wood but merely retard it, and that apparently there is no difference in moisture absorption through the coating due to the species of wood used.

The panels used in the experiments were of yellow birch, basswood, red gum, African mahogany, white ash, white pine, Sitka spruce, southern yellow pine, bald cypress, incense cedar, white oak, western yellow pine, Port Orford cedar, and sugar pine.

Three coats of high grade spar varnish were applied to four panels of each species. Two panels of each species were brush coated and two were dipped by a special dipping machine designed to secure an even coating. The panels were allowed to dry 72 hours between coats and ten days after the final coat before they were given the moisture-resistance test.

The moisture-resistance test consisted in exposing the panels for 17 days to a humidity of 95-100 per cent, or in an atmosphere practically saturated with moisture.

At the end of this test it was found that all the brush-coated panels had absorbed between 5 and 6.5 grams of moisture per sq. ft. of surface, and the dipped panels between 4 and 5 grams. Such variations in amount of absorption as appeared could easily have been due to inequalities in the application of the varnish. It was quite noticeable that the dipping process produced a more moisture-resistant coating than brushing.

Legal Aid for Employes

In less than a month's time 853 employes of the Firestone Co., of Akron, received counsel at the legal advisory department, which has just been put into operation. It means that an average of 30 persons receive advice each day on subjects varying from federal insurance to the making of a will.

While a large proportion of the clients are looking to the safe disposal of their property after death a large number are also interested in the important matter of contracts, especially those dealing with real estate. The department found that thousands of dollars have been lost annually by the employes of the company because they have entered into agreements for the purchase or repair of real estate and have failed to have these agreements put in writing. Interviews with 100 people during the period of a month brought forth stories of losses of from $50 to $500 each as a result of not taking this precaution.

One typical day's work was the writing of a lease, formulating a will, drawing up two deeds, examining one abstract, advising two persons relative to domestic matters, assisting two soldiers in regard to government allotments, and five others regarding federal insurance, and making an appearance before a justice of the peace which resulted in the dismissal of a case wrongly brought against a workman of foreign birth.

New German Motor Vehicle Fuel

Benbol oil is the name which has been given to a new fuel for motor vehicles which has been produced in Germany. This fuel is a mixture of equal parts of benzol (obtained in gas works, or otherwise in the destructive distillation of coal) and Diesel-engine oil. Its practicability has been tested by the road vehicle testing commission, Berlin. The material will be used as a substitute for gasoline and benzol until further notice. It is of yellow to reddish-brown color, has a specific gravity of 0.84 to 0. 895, and evaporates between 68 and 200 deg. C.

In view of these properties, which characterize benzol oil as a fuel difficult of vaporization, some care is required when using it for road vehicle propulsion. The delivery of the mixture must be carefully regulated so that sufficient air is given and a preheating device of some kind is evidently necessary. Starting up is effected by injecting gasoline or benzol into the cylinder, although the engine will generally start on benzol oil.—Abstracted by Technical Review from Zeitschrift des Vereines deutscher Ingenieure.

Army to Have "Flivver" Tanks

According to the latest reports from Washington, army ordnance officials there are experimenting with a new three-ton truck, which is but half the weight of the whippet tank, the smallest previously produced. The latter weighs six tons while the new models will weigh but three tons. No details of the new model are available as yet. The tank program of the army includes 100 30-ton tanks, 950 whippets and 15 of the new three-ton model, as well as 267 30-ton, 400 20-ton, 2,800 10-ton and 4,000 5-ton tractors.

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British Public Wants American Cars

Recently when the British import restrictions on American motor cars and trucks were removed by the official suspension of the Board of Trade licensing restrictions, the British automobile manufacturers protested, and it was expected in the trade that this might result in a restoration of the restrictions. It develops now, however. that the restrictions were removed mainly because the British public likes and wants American cars, that the former prejudice against them has almost entirely disappeared.

A contributor to a British motor trade journal comments on the situation in this way: "Quite honestly, there is no better value for the money in the motor world than the average American car. The point at the moment, however, is not exactly one of sheer value, but whether in our own best interests in the long run we should admit the vehicles freely, ration their import, or bar them altogether.

"At the present time there is a desperate shortage of motors in this country. Our own manufacturers, owing chiefly to circumstances over which they have no control, are unable to meet the demand, and so to some extent we benefit immediately by importing motor vehicles from the United States.

"At the same time the fact remains that the American factories cannot for a considerable time meet even their own demands, yet they are willing to keep their own market short in their attempt to consolidate and increase their foreign markets. There is ample food for thought in this fact."

Ideal Airplanes for Pleasure and Business

In an article contributed to the Sunday Times, London, "Wing Adjutant" (Maj. W. T. Blake) gives the following specifications for what he considers would be the ideal car for (1) pleasure and (2) commercial purposes:

(1) Length. 22 ft.; span, 30 ft.; height, 7 ft.; engine, 50 h.p., air cooled, radial; accommodation, two abreast in partialy inclosed cabin; top speed 90 miles per hour; cruising, 75 miles per hour; landing, 40 miles per hour: rising, 40 miles per hour; range, 300 miles; duration, four hours; cost, $2,500; upkeep, 24 cents per mile.

(2) Length, 45 ft.; span, 100 ft.; height, 15 ft.; engines, two, 400 h.p., stationary, water cooled; passenger accommodation, 20 (plus two pilots); top speed, 100 miles per hour; commercial, 90 miles per hour; landing, 45 miles per hour; rising, 50 miles per hour; range, 350 miles; duration, four hours; cost, $25,000; upkeep, $1.80 per mile. (At present firms are charging $100,000 for a machine of, roughly, these capabilities.

Dodge Bros. May Build in Mt. Clemens

Options have been taken by Detroit agents claiming to represent Dodge Bros., on 600 acres of land in Mt. Clemens, more than half of which borders on Selfridge Aviation Field and adjacent to other land which has recently been optioned by oil men and where drillers are about to start work. It is stated unofficially that the Dodge company plans to erect a large manufacturing plant, work upon which will be started immediately. It is said also that the plans for extending the Dixie Highway include its crossing the plot optioned by the Dodges.

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The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXI NEW YORK, DECEMBER, 1919 No. 9

Utility and Convenience of Motor Buses

The Different Ways in Which the Motor Bus Is An Improvement Over Any Other Method of Transportation—Instances of Savings—Municipal and Industrial Uses

MANY recent events have drawn attention to motor buses as an improved method of transportation. During a recent strike in Brooklyn, N. Y., when the usual car service was interrupted, motor bus service sprang up as if by magic, and in a few days these vehicles were carrying upwards of 100,000 people twice a day. The more recent coal shortage, which contracted the railroad service and promised to shorten the trolley service all over the country, gave many instances, especially in the case of isolated plants, schools and other institutions or plants, of the advantages of the motor bus.

What are these advantages?

Present traffic congestion in our larger cities call for more better paved streets and more traffic freedom on them. This much desired result, which is soon going to be imperative, can only result from reducing the number of street car tracks. Street car tracks can be removed only when buses are substituted for surface cars. In large cities there is no room for more tracks; in smaller towns these are unnecessary; in both cases the motor bus points the only way out. Street cars stop at crossings and force a blockade of all traffic in so doing. In part this would be avoided by the use of motor buses of equivalent capacity. Thus buses in place of surface cars would mean reduced traffic congestion.

The bus system is more flexible both as to the use of fixed routes, or in the matter of frequency of operation. This is emphasized by considering a car system. First it must be estimated what revenue a certain route will bring, and then when the arrangement of the route and the sections reached appear to indicate sufficient passenger traffic to show a profit from operation, the franchise is obtained, tracks laid, power plant built, rolling stock obtained, and all the other formalities gone through with. If then, when operation begins, it is found that the traffic is not up to the estimates, the frequency of operation can only be cut down to a minimum and operation continued at a minimum loss. Starting a motor bus line entails none of this long waiting and planning. Given a projected route, it is only necessary to start running the buses over it, when a few days operation will show whether it can be made profitable or not. If not, it can be shifted over a street or two here, a block or two there, in an effort to improve it, and then if still found wanting, can be shifted on a few moments' notice to an entirely different section. In short, the bus line offers the extreme in flexibility.

Fig. 1—Side view of the new Chicago buses which have 30 per cent additional earning capacity through increased seating and enclosure

Buses are safer than surface cars. The rails are generally located in the center of the street and passengers must go to and come from this point to reach the curb and safety every time they get on or off. The bus, on the other hand, picks up and discharges all of its passengers at the curb. In wet, snowy, or other disagreeable weather, the fact that

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this is so much nearer to office or other buildings offering shelter, is an added item of comfort and convenience.

The use of rubber tires and softer springs make motor buses ride more comfortably, in addition to which it generally is the policy to provide a larger proportion of seats and a smaller proportion of standing room, and decline to take on more passengers when all seats are filled. The items add materially to the comfort of each individual passenger.

Buses are quicker to start, travel faster, and stop more quickly than do surface cars. This means that for any given distance the bus will generally present a swifter service than the trolley car over an equivalent route.

Aside from such city and suburban uses, in which it may be considered a competitor of the surface car, the motor bus has many other equally valuable advantages. In many suburban and rural communities, the schools have been concentrated in a single central building, and the pupils collected and brought to this via community-owned motor buses. This makes for a better education all around; the concentration allows of hiring better teachers; the bus system makes for better and more regular attendance; the school becomes a more important factor in the community life; everyone is benefited, while the continuous use of the motor bus will in time call for better, hard surface roads, which again benefits everyone.

Desirable factory space in the larger cities is at a premium, especially that which is well located in respect to a supply of labor and transportation of this labor to and from work. By removing to a suburban locality and having its own system of transportation in the form of a fleet of motor buses, any firm or business is better off, and saves money. The employes, as well, save their daily carfare, while this method reacts favorably on the morale of the entire organization. Moreover it puts the business employing this method beyond the influence of street car companies with their possibilities for strikes, interruption of service by power house or other accidents, etc.

The motor bus is the extreme of flexibility in that it can be used for, let us say, summer resort traffic in the warm summer months, and shifted to other traffic in the winter when this is unprofitable. It can be used in the mornings and at night for workingman traffic, during the balance of the day for shopping service, and in the evening for theatre traffic, slum sightseeing work, or anything else, all in different sections of the city, if this is desirable. In short, the bus can be used wherever traffic will make it profitable, and can be shifted to other work, another kind of service, the minute it becomes unprofitable.

A general realization of these factors has led to such a demand for various forms of motor bus bodies that it is now possible to obtain from truck or wagon firms practically any size, type or form of passenger-carrying body desired. The illustrations herewith show buses of varying types and sizes having respectively 60, 33 and 100 passengers capacity.

The bus shown in Fig. 1 is the newest form used by the Chicago Motor Bus Co. on the streets of that city, and as

Fig. 2—A Philadelphia bus body of usual single-deck type on a Mack chassis—It seats more than 30 passengers in crosswise seats

will be noted has the upper deck entirely enclosed. This is accomplished without unusual height through front wheel drive and low hung, stepless body. In addition, the stairs to the upper deck are enclosed. This car seating 60 is 25 ft. long, 7 ft. 6 in. wide, and 12 ft. 11 in. high unloaded and 12 ft. 8 in. with capacity load. The increased capacity over older type buses is 18 per cent, but in actual use these new models have shown an increase of 29 per cent, doubtless due to the protection afforded against wind and weather.

Another simple type of bus is shown in Fig. 2, of which Fig. 3 is an interior view. This has a seating capacity of 33, there being eight seats on each side for two persons each, and one additional central seat at the rear. This body measures 21 ft. 7¼ in. long from the dash to the rear end, 7 ft. 6 in. wide, and 6 ft. 8 in. high from floor to roof. The 3½-ton truck chassis has a wheelbase of 16 ft. (192 in.)

Quite a different form is indicated in Fig. 4. This shows

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Fig. 3—Interior of the bus shown in Fig. 2, looking toward the rear and showing the extra central seat there

a special trailer bus, constructed to be used with a tractor, or short wheelbase truck. It was built by a Texas wagon company for the Texas Co., and is used by the latter to transport employes to and from the works at Morgan, La., which is inadequately served by railroad. The body has a seating capacity of 80, and regularly carries between 85 and 100 people. It is 25 ft. long, 9 ft. wide and is constructed of oak frames and steel panels. Four seats run lengthwise, one on each side and two in the center. The rear end of the tractor is fitted with a tilting fifth wheel which carries the front end of the body, while the rear wheels and axle turn under the body so as to track with the wheels of the tractor. In this way, despite an overall length of perhaps 35 ft., it can be turned or maneuvered in as short a space as an ordinary big truck of, say, 14 ft. (168 in.) wheelbase.

In connection with the operation of municipal buses, it should be pointed out, however, that this is similar to any other business venture, and requires much skill, a wide knowledge of transportation, an intimate knowledge of motor vehicles and their operation on the one hand, and their limitations on the other. The Fifth Avenue Bus Co., New York, is a splendid example of motor bus operation in this country, but at the outset, it must be stated, that the highest order of motor and transportation skill were brought to bear upon this system from its start. Moreover, all of its early vehicles were written off complete in five years; that is to say, depreciation was figured at 20 per cent. It is now known that this is too high, and the bus company no longer uses this figure. But it should be mentioned that during all of these first five years when the rolling stock was being written off, the company did not make a cent. After the fifth year, when this tremendous amount for depreciation was no longer charged against the service, the firm began to make money. In the fiscal year of 1918-1919, ending June 30 last, the company operated 279 active or revenue buses and 49 non-revenue units, an increase over the previous year of 40 vehicles. These covered 8,022,026 bus miles (including 125,551 "idle" miles) and carried 36,488,447 passengers at a straight fare of 10 cents. Operating expenses totaled 29.03 cents per bus mile and with taxes 6.02 made the total cost per mile 35.05. Revenue per mile (including livery service, advertising privileges and miscellaneous, in round figures $95,000) was 46.28, so that the income from operation was 11.23 cents per bus mile. The net income for the year was $843,958.52, and the corporate surplus had increased to $2,082,514.84. Some idea of the replacements of parts and the volume of the repair work may be gained from the items, "Materials and supplies," $432,558.54; "Shop and miscellaneous equipment," $150,519.46; and "Construction (body) in process," $41,833.54; last year, $769,946.

Commercial cars to the extent of practically $3,000,000 (in round figures, $2,931,203) were exported in October. This compares with a little over $2,000,000 in the same month of last year. In number of vehicles the increase is even greater, 1,301 as compared with 737, or within about 100 of twice as many. This makes the total for the ten months 12,367 trucks, worth $29,687,118. Small countries took about one-half, France about one-quarter, and Canada one-eighth.

Formaldehyde has been used in some manufacturing processes to coagulate casein, but as an agent for rendering casein glue less soluble it has not proved successful in experiments made at the U. S. Forest Products Laboratory.

Fig. 4—Trailer type of bus body, built by Texas Wagon Works, Houston, Tex., to go with short wheelbase Mack tractor—It accommodates 100 people

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Late News of the Big Automotive Shows

Olympia Show Very Successful

The annual show of the Society of Motor Manufacturers and Traders, held at Olympia, London, November 7-16, the second big display following the war, was unusually successful. This success included not alone attendance and popular interest but also the actual sales of cars, as displayed.

The total attendance exceeded 300,000, which is greater than ever before. The popular interest was unusual, and any kind of a car which actually was for sale or could be bought, was eagerly snapped up.

Many manufacturers sold their entire output for 1920 and half of that for 1921. This, too, on the basis of prices $500 per car above those announced earlier in the year, and also subject to further upward revision.

Due to a foundry and other strikes production is not proceeding very rapidly, and few makers with plans for big outputs along American lines have gotten under way. Moreover, those with the biggest plans, such as Angus Sanderson, Austin and others, are rapidly increasing their retail prices. This would seem to indicate that they despair of reaching the output previously set as their goal, and upon which the earlier low prices were based. Only six British manufacturers are producing more than 30 cars weekly. So few deliveries have been made in recent weeks of the post-war models that charges are freely made that manufacturers are co-operating to maintain high prices.

The passenger car show was followed at Olympia by the motorcycle display, which opened on November 24. The models shown indicated remarkable development of two-cylinder horizontal opposed and single cylinder two-cycle motors. Neither of these forms have attained any popularity in this country, and up to now, in Britain either.

Among the motorcycle features it was noted that no pressed steel frames are used, generally lighter construction, side cars are very widely furnished and are equipped with top, door, windshield, and are priced as high as $800. There are no radical developments, and most of the cycles are small production forms.

Four American manufacturers are represented: Reading, Indian, Harley Davidson and Standard.

Plans for New York's Big Show

Plans are completed for the big National display, the Twentieth Annual Automobile Show, to be held in New York January 3-10. The decorations of the past will not be in evidence, and for once, this car show will have as its principal feature just cars. By obtaining the huge Eighth Coast Artillery Armory for the truck and trailer display it will be possible to give up the whole of the four floors in Grand Central Palace to the cars and the accessories which are strictly for cars.

Many newcomers will be seen at the big display, some being exhibited for the first time at any show. These include Comet, Maibohm, Monitor, Sayers and Stevens-Duryea. All told there will be more than 83 makes of passenger cars, and in the two parts of the exhibition 284 accessories. The passenger car exhibit list includes the following makes: Allen, American Beauty, Anderson, Apperson, Auburn, Biddle, Briscoe, Buick, Cadillac, Case, Chalmers, Chandler, Chevrolet, Cleveland, Cole, Columbia, Comet, Commonwealth, Crow-Elkhart, Davis, Detroit-Electric, Dixie Flyer, Dodge Bros., Dorris, Dort, Elcar, Elgin, Fiat, Franklin, Grant, Haynes, Hollier, Holmes, Hudson, Hupmobile, Jackson, Jordan, King, Kisselkar, Klinekar, Lexington, Liberty, McFarlan, Maibohm, Marmon, Maxwell, Mercer, Metz, Milburn Electric, Mitchell, Moline-Knight, Monitor, Moon, Nash, National, Oakland, Oldsmobile, Olympia, Overland, Owen-Magnetic, Packard, Paige, Paterson, Peerless, Pierce-Arrow, Premier, Reo, Roamer, Saxon, Sayers, Scripps-Booth, Standard, Stanley, Stearns-Knight, Stephens Six, Stevens-Duryea, Studebaker, Stutz, Templar, Velie, Westcott, Willys-Knight, Winton.

The armory is located at Jerome avenue, Kingsbridge road, and 194th street, but is conveniently reached by Lexington or Seventh avenue subways, and Sixth or Ninth avenue elevated. It is one of the largest buildings of the kind in the world and offers an unobstructed floor space measuring 300 x 600 ft. The roof is 110 ft. high. In this tremendous space it will be possible for the first time to display all the big trucks, trailers, bodies, and truck and body accessories to good advantage. There will be 67 makes of motor trucks exhibited, including: Acason, Acme, Ace, Armleder, Atterbury, Autocar, Bethlehem, Brockway, Clydesdale, Commer-Corbitt, C. T., Defiance Denby, Diamond T, Dodge Bros., Dorris, Federal, F.W.D., Garford, Gramm-Bernstein, Graham, Huffman, Hurlburt, Indiana, International, Jackson, Jumbo, Kelly, Kissel, Koehler, Maccar, Master, Maxwell, Nash, Oldsmobile, Oneida, Packard, Paige, Pierce-Arrow, Rainier, Reo, Republic, Rowe, Sandow, Sanford, Schacht, Schwartz, Selden, Standard, Sterling, Stewart, Sullivan, Trailmobile, Transport, Three Point, Triangle, Union, Velie, Vim, Walker, Walter, Ward, Ward La France, Wilson, Winther, Keystone, Highway Trailer, Warner Trailer, Metropolitan Body Co., Inc., Parry Mfg. Co.

Coincident with the truck show will be held the sessions of the Highway Transport Conference at the armory at 2:15 and 8:15 p. m. daily. These will cover all highways and transportation problems, and will include prominent speakers, notable papers and articles, and discussions. The afternoon sessions have been planned primarily for those engaged in the motor truck business, as manufacturing, distributing or service. The evening sessions are for truck owners and operators, shippers and the general public. Better marketing and distribution to decrease the cost of living, via motor trucks, will have prominent places in the evening sessions.

Brooklyn Show for Early February

The Brooklyn Motor Vehicle Dealers' Association has announced the date for its ninth annual show. This will be held in the Twenty-third Regiment Armory during the week of February 14-21. Passenger cars and trucks will be exhibited together for the first time, the former in the center of the huge floor space and the latter around the outside spaces. This has been made possible by exhibitors cutting down their spaces.

(Additional Show News on page 21)

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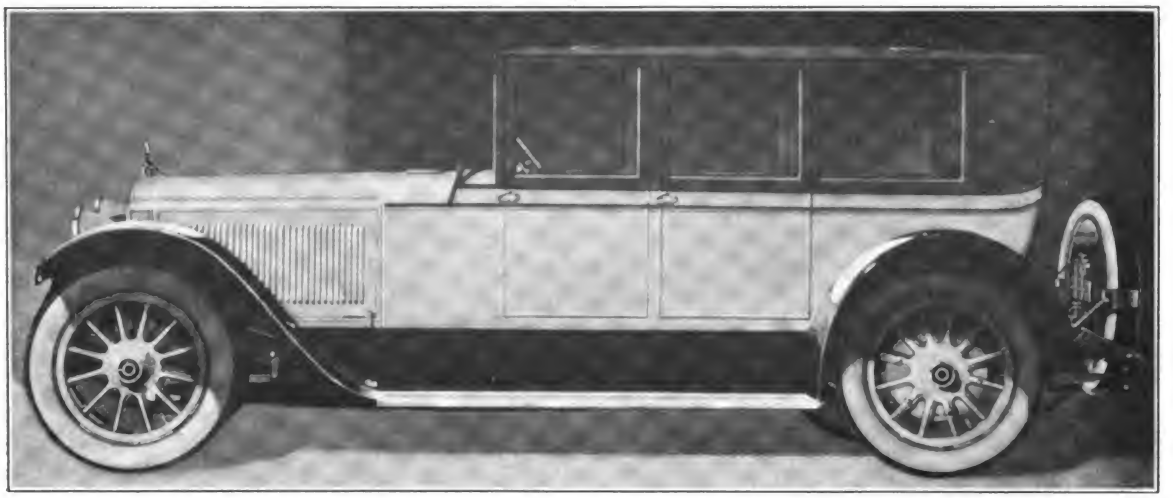
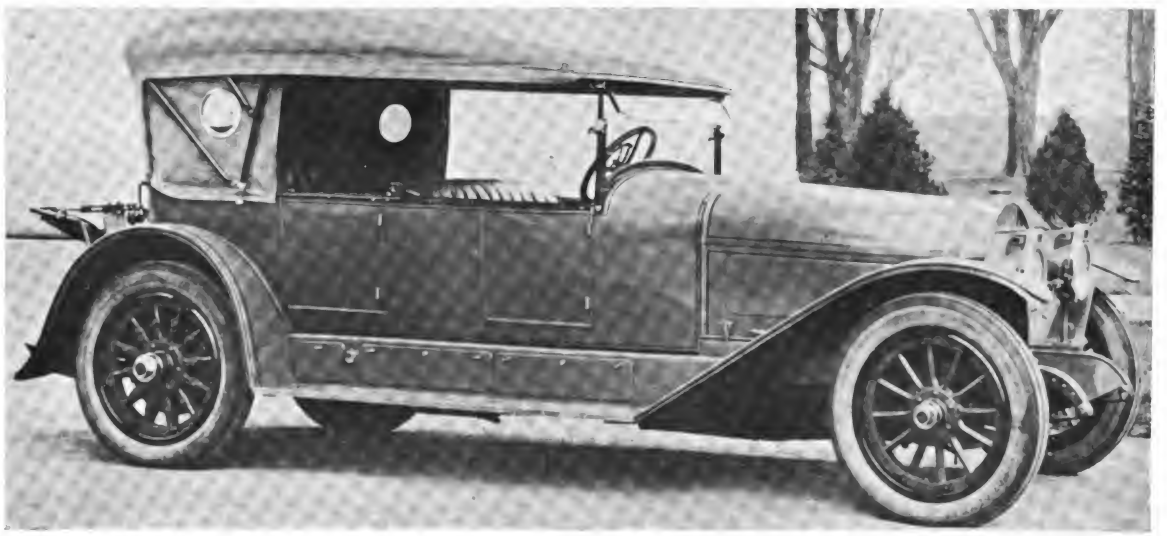
Examples of the Best American Coach Work



SEVEN-PASSENGER BERLINE
Roomy D-Front Body by Rubay Co., Cleveland, O.
Mounted on Packard Chassis



FOUR-PASSENGER TOURING CAR
Special Straight-line Model Built by Custom Body Dept.
Locomobile Co. of America, Bridgeport, Conn.

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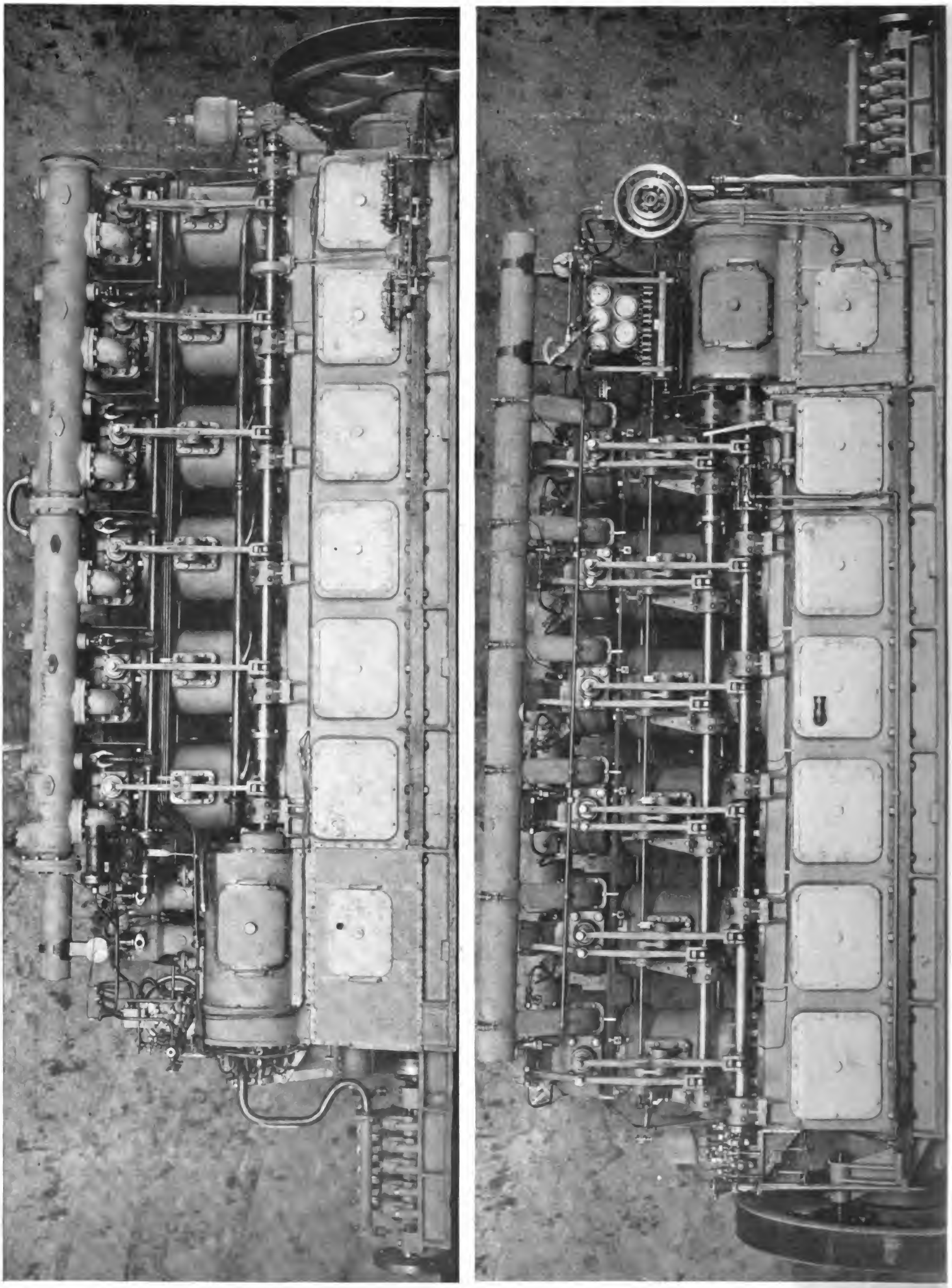

Fig. 1. Above—Exhaust side of the 300 Nelseco Diesel-type Marine Engine, showing exhaust header, exhaust camshaft, rocker arms and valves. Below—Inlet side of the 300 Nelseco engine. [illegible] and rockers are [illegible] inlet and spray valves.

Nelseco 360 H.P. Heavy Duty Marine Diesel-type Engine

Features of This Large Commercial Unit, Built Along Conservative and Proven Lines—Successful in Pleasure and Work Boats of 100 Feet and Over

ONE of the first, if not actually the first, constructors of Diesel-type engines in this country was the New London Ship and Engine Co., Groton, Conn. This company started business in 1910 and turned out Diesel engines in 1911, and has continued to turn them out in such quantities that today it is the largest manufacturer of this type of engine in the United States. The plant is well located on one of the finest harbors along the Atlantic coast, and consists of main office or administrative building, machine shop, gray iron and steel foundry, forge shop, pattern shop, coppersmith shop, power plant, screw and bolt shop, and store room. In conjunction with its modern and well equipped plant, the company maintains a large hotel for its workmen, and in an adjoining park has erected many homes for its employes.

The products of the company have been used with success in fishing boats, tugs, passenger and cargo vessels, seagoing ships, yachts, submarines, submarine tenders, and others. All operate on the full Diesel principle and are self-starting. They burn crude or fuel oil, which is very low in price, and all engines are guaranteed to consume less than ½ lb. per h.p. per hour. As this oil weighs about 8 lbs. per gallon, this is 1/16 gal. per h.p. per hour.

Five sizes are now built, the 120, 180 and 240 h.p. having the same bore and stroke, 9 x 12½ in., and four, six and eight cylinders respectively. The 360 h.p., to be described in detail and typical of the full lines, has six cylinders, and 13 x 18 in. bore and stroke. A larger unit, rated at 1,000 h.p. at slightly higher speed, that is 375 r.p.m., has six cylinders, but other details are not available.

The engine, shown in Figs. 1, 2 and 3, is of the heavy duty four-cycle, reversing gear type, working on the full Diesel principle and using crude or fuel oil for fuel. It develops 360 h.p. at 240 r.p.m. Cylinders are of cast iron, cast separately, and have water-jacketed barrels and heads.

The working cylinder heads are cast separate and contain all the various valves. Each cylinder head has an inlet and relief valve on the front of the engine, a spray valve on top, and an exhaust valve on the back. This construction can be noted in Fig. 3, which shows a cross section through the engine.

The inlet valve is of forged steel and carried in a separate cage. It is shown in detail in Fig. 4.

The exhaust valve, Fig. 5, has a steel stem with cast iron head of special design to withstand action of exhaust gases.

The spray valve has a steel needle with atomizer and cage of special design, as will be noted in the working drawing, Fig. 6.

The crankshaft is of forged steel in two pieces, designed to meet Lloyd's requirements. The connecting rods are of forged steel with solid wrist pin ends fitted with phosphor bronze bushings and tee head crank ends for bolting to crankpin boxes. The crankpin boxes are of cast steel lined with white metal.

The wrist pins are steel forgings, hardened and ground and secured in pistons.

The pistons are of cast iron of trunk type and fitted with cast iron snap rings to retain compression.

The bedplate is in one piece, of cast iron, and is enclosed to catch all oil draining from bearings. Flanges are provided on the bottom, for bolting to the foundation, and on the top for carrying the housing. Cross girders are provided for the main bearings of crankshaft. These bearings have cast iron shells lined with white metal, with semicircular lower brasses so that they may be rolled out after removing weight of crankshaft.

The housing is in one piece of cast iron of rigid design and bolted direct to the bedplate. Large openings are provided on both sides for access to crankpit. To top of housing are bolted working and compressor cylinders and camshaft bearings. Fig. 3 shows the shape of the bedplate and housing, and Figs. 1 and 2 indicate the size of the hand hole plates.

The two camshafts, carried in white metal lined cast iron bearings on top of housing, are driven from crankshaft by spur

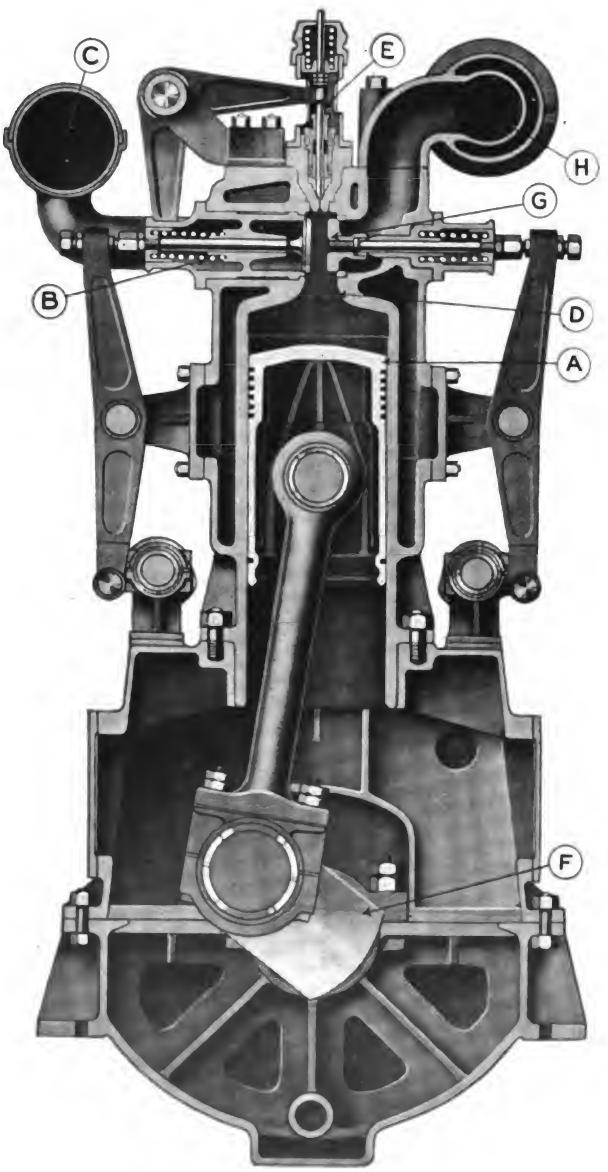

Fig. 3—Cross section of Nelseco engine. A, piston; B, intake valve; C, intake manifold; D, cylinder; E, fuel valve; F, crankshaft; G, exhaust valve; H, exhaust manifold

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gears on one end of the engine. The camshaft back of engine operates exhaust valves by rocker levers. The camshaft on the front of engine operates inlet valves by rocker levers and spray valves by rocker and bell crank levers. Three cylinders are fitted with air starting valves operated from front camshaft. The gear of these valves is so arranged that when they are in operation spray valves on these cylinders are cut out, and when spray valves are operating, starting valves are cut out.

At the after end of the engine there is a twin air compressor for supplying air for injecting fuel and for starting purposes, provision being made on three cylinders for air starting. The compressor is of the two-stage tandem type, and provision is made for regulating pressure carried on spray air by throttles on the first stage suction.

The first and second stage air compressor cylinders are in one piece, of cast iron, water jacketed and with a separate water jacketed cast iron second stage head. Both first and second stages have automatic valves.

The air coolers placed on the back of the engine oppo-

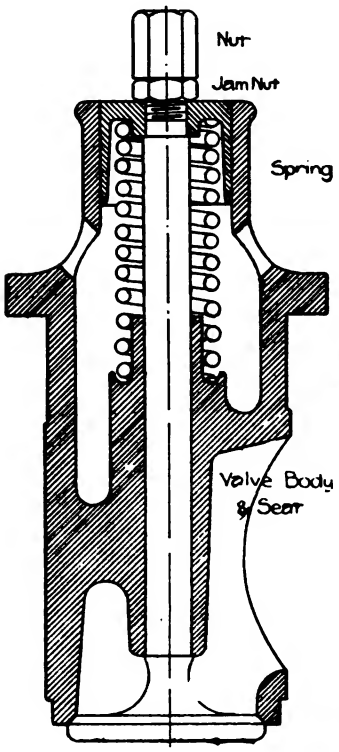

Fig. 4—Section through inlet valve, showing details of valve, spring and cage

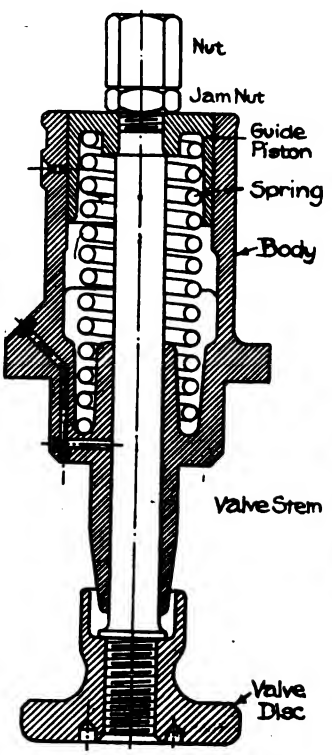

Fig. 5—Exhaust valve section, indicating screwed on cast iron valve head

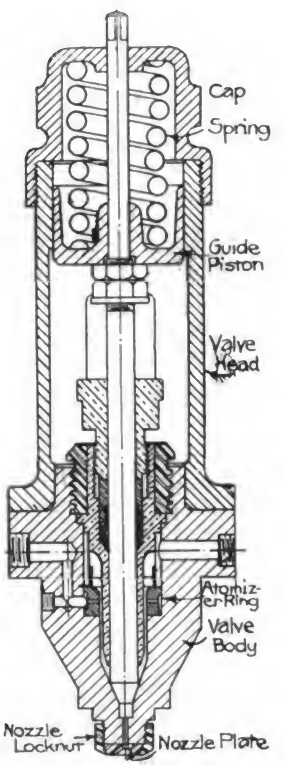

Fig. 6—Detail drawing of spray valve, showing construction and method of working

DATA ON NELSECO 360 H.P. DIESEL

Type—Single acting four-cycle.
Horsepower—360.
Revolutions per minute—240.
Number of cylinders—6.
Bore—13 in.
Stroke—18 in.
Ratio bore/stroke—1/1.384.
Output per cyl.-h.p.—60.
Cylinders—Cast iron, cast separately.
Bedplate—One-piece cast iron.
Cylinder heads—Cast separately, cast iorn.
Inlet valve—Forged steel.
Exhaust valve—Steel stem, cast iron head.
Spray valve needle—Steel.
Crankshaft—Two-piece forged steel
Connecting rods—Forged steel.
Fuel consumption—22½ gals. per hour.
Oil consumption—¼ gal. per hour.
Length overall—31 ft.
Width overall—5 ft. 6 in.
Height from center line—7 ft. 8 in.
Diam. flywheel—6 ft.
Diam. thrust shaft—6⅛ in.
Diam. inter. shaft—5⅞ in.
Diam. prop. shaft—6⅝ in.
Diam. prop.—Approx. 75 in.
Weight, net—Approx. 48,700 lbs.
Weight per h.p.—135 lbs.

site compressors, have separate passages for first and second stage air, and have sufficient surface to cool air thoroughly after each stage of compression.

A spray air flask is secured to back of engine and is connected into line between compressor and spray valves.

The intake air for working and compressor cylinders enters through the individual mufflers attached to intake connections on the cylinders.

The exhaust manifold runs along back of engine, is secured to tops of cylinders, and is of cast iron and water-jacketed. The exhaust muffler is of suitable design to silence exhaust.

The flywheel is bolted to a flange on the forward end of the crankshaft.

The reverse gear is of the heavy duty mechanical type, with friction discs for ahead motion, gears and band clutch for astern motion. The thrust bearing is of the horseshoe type and of ample size.

A governor driven from back camshaft is located at forward end of engine and controls engine speed by holding open fuel pump suction valves.

The fuel system consists of a pump located at forward end of engine and driven from front camshaft extended, with a separate plunger for each cylinder. Fuel is supplied to pump from the gravity tank, which is divided into two parts with a filter between, so that no foreign matter can get to fuel pumps. The discharge from each individual fuel pump leads to its respective spray valve. The speed of engine is controlled by amount of fuel supplied to cylinders, which in turn is controlled by timing of individual pump suction valves. There is a separate rotary lift pump on the engine by which the gravity tank can be filled from main fuel oil tanks.

Forced lubrication is used for the principal bearings, oil being supplied under pressure from the gravity tank to the main bearings, and thence passing through holes drilled in the crankshaft to crankpins and through connecting rods to wrist pins. All surplus oil drains back to crankpit, and is returned to the gravity tank through a strainer and cooler by a rotary pump driven from the engine. The crankcase is oil tight to prevent leakage of oil outside. The cylinders are supplied from a positive feed mechanical oiler. Reverse gear and thrust shaft bearings are oiled from sight feed oil cups. Camshaft and other bearings, except those subject to very little motion which are oiled by hand, are fitted with grease cups.

This system supplies cooling water to the air compressor, working cylinders and the exhaust header. There is a large water pump of the plunger type, driven by gears at slow speed, and of ample capacity to keep engine cool under all conditions.

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The Army Motor Service*

By LT. COL. J. M. RITCHIE†

The Economy of Pooling Transportation—Necessity for Standardizing Equipment—Need of Good Roads and the Part Engineering Societies Should Take in Their Development

THE records indicate that from the earliest periods of history down to the present day transportation has been the deciding factor in all wars.

The adversary who could keep his troops supplied with the materials necessary to conduct warfare, whether those materials consisted of weapons, ammunition, food, or what not, was the ultimate victor.

History shows that the earliest form of transportation was man himself. The tribes of the ancient world brought food and supplies to their armies by means of runners who carried these materials on their backs.

Then came successively the horse, boats, rail, and finally, in the recent war, the motor vehicle.

This latter form of transportation, still in its infancy, has demonstrated its value as part of a well-developed war machine.

In 1915 there were less than 200 motor vehicles in the whole army. When the Mexican punitive expedition was organized in 1916 this amount was increased to approximately 4,000 vehicles, the great majority of which were in the southern department, along the Mexican border. The United States entered the world war with this complement of vehicles.

Until August 15, 1918, each bureau, corps, or department of the army was authorized to purchase its own motor equipment, which resulted in the selection of many and varied types of vehicles. This soon resulted in a chaotic condition. It became practically impossible to maintain these vehicles, due to the inability to obtain spare parts. This spare parts question was the most serious maintenance factor the army faced and was due largely to the unequal distribution, both commercially and in the army.

With a view to eliminating these troubles, to reducing the cost of operation, and to centralizing the control of the operation and maintenance of motor vehicles, the Motor Transport Corps was established August 15, 1918, under G. O. 75, W. D.

Organization of Corps

The Motor Transport Corps was charged, under this order, with the design, procurement, operation and maintenance of all motor vehicles.

The Motor Transport Corps, for the purpose of administration, is divided into four main branches, namely, executive, service, operations, and maintenance. The functions of these divisions are as follows:

The executive division is charged with all administrative matters, including office management, correspondence, issuing and transmitting of orders, bulletins, circulars, and memoranda for the Motor Transport Corps; handles all questions of estimates for appropriations; acts on surveys and property questions, including procurement and policy of finance and disbursements, supply and records of personnel; has charge of all questions of training; charge of all questions of domestic and overseas liaison pertaining to the Motor Transport Corps; and performs such other duties as may not be specifically assigned to some other division.

The service division is charged with the gathering and compiling of all information and statistics necessary for the study of the Motor Transport Corps by those charged with its direction; with all questions of organization and proposed projects of the Motor Transport Corps; with keeping informed on the tables of organization issued from the war college; with computing and preparing all personnel, vehicle and supply requirement tables; with all questions of contemplated changes in policy of the Motor Transport Corps; with the determination of the actual efficiency of the Motor Transport Corps in all of its activities; with the collecting and filing of all documents issued by or affecting the Motor Transport Corps, as far as its larger achievements are concerned, especially those documents that have or will have a definite historical value as showing the causes and results of the various actions taken by the corps; with all questions of design and specifications of motor transport vehicles; and with collecting engineering data with reference to the performance of motor transport equipment.

Duties of Operating Division

The operations division is responsible for the registration of all motor vehicles of the Motor Transport Corps, and for the grouping and execution of all assignments and transfers of motor vehicles of the Motor Transport Corps; for all questions of control and movements of motor convoys; and for determining, marking, mapping and publishing approved road routes of travel and traffic control regulations; for the reception of new motor vehicles from manufacturers, serviceable and unserviceable retired from service, repaired and overhauled vehicles released from shops, and holds equipment awaiting assignment to organizations or entrance to repair shops, and performs all storage plant functions.

The maintenance division is responsible for the repairing of all motor vehicles of the Motor Transport Corps; for requisitioning, following up procurement; and for the distributing, upon requisition or otherwise, of all spare parts, material and equipment pertaining to the Motor Transport Corps; for distribution and operation of all motor transport base and field repair shops, depots, garages, repair parks, and for the salvaging of motor vehicles and parts, analyzing and reporting of all failures in equipment.

Registration of Vehicles

For the purpose of ease of identification and to facilitate the collection of data, motor vehicles are divided into types, such as:

Type 1—Passenger cars.
Type 2—Light delivery trucks.
Type 3—1½ and 2 ton trucks.
Type 4—3 and 4 ton trucks.
Type 5—5 ton trucks.

* Address September 30, 1919, the Engineers' Club of Philadelphia.
† Member Motor Transport Corps, U. S. A.

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Type 6—Motorcycles.

Type 7—Ambulances.

And each type is numerically numbered within its own group. For instance, all passenger-carrying vehicles are Type 1; thus U. S. A. No. 1126 is car No. 126 of Type 1, while U. S. A. No. 2126 is truck No. 126 of Type 2, and so on through the various types. A record of the cost of operation and maintenance of each vehicle is kept and entered on the master card in the registration branch, operations division.

Two classes of vehicles were established, namely, 1 and 2. Class 1 vehicles include all passenger and cargo-carrying vehicles not enumerated in Class 2, which class embraces those vehicles assigned to combatant units, in accordance with tables of organization, or vehicles of a special design which could not be used for any other purpose than that for which they were designed, such as fire engines, balloon winch trucks, wireless telegraph trucks, etc. The Motor Transport Corps exercises technical supervision only over Class 2 vehicles and is charged with their maintenance. Full control of the operation and maintenance of Class 1 vehicles is exercised by the Motor Transport Corps, and as this group comprised approximately 80 per cent of all the vehicles in the army, its activities are very extensive.

Method of Operation

All vehicles were pooled and no individual assignments were made except to commanding generals, who by virtue of their duties required service available at all times.

In the larger cities, such as New York, Philadelphia, Washington, Chicago and Detroit, a taxi service was installed to handle the passenger service. In the city of Washington, for instance, this service was quite elaborate, and comprised eight garages, 15 taxi control stations and operated 235 cars and 100 motorcycles with said cars, daily. During active operation this service was operated on a 24 hour basis, but after the armistice was signed it was reduced and continues to be further reduced as rapidly as the best interests of the service will permit.

All of the garages and control stations operated from a central switchboard located at headquarters, under the direction of a chief dispatcher. Cars were kept at each control at all times by moving up from the nearest station. Each control station reported the number of cars at the station every 15 minutes, and in this manner the exact status of the circuit was known. To reduce the dead mileage a taxi leaving at one end of the city for some distant point did not return to its originating station, but checked in at the nearest control, where it was reported to the chief dispatcher on the next 15 minute report.

It might be well at this time to give a few statistics to show the efficiency of this system. At the time the Motor Transport Corps assumed control of the motor service it took over 235 vehicles, which carried 750 passengers daily. Within 30 days this number of vehicles was reduced to 150, while the number of passengers carried increased to 3,000.

In addition to this, a bus system (12 buses) was installed, operating between the main buildings on a five-minute schedule, and these cars carried about 1,700 persons per day, so that with 162 vehicles approximately 4,700 persons per day were given motor service in the city of Washington.

The cargo transportation has been operated on similar lines. Information was gathered to ascertain the minimum daily requirements of various capacities of trucks, and this quantity was detailed daily to the various loading points. No truck was permitted to stand more than 30 minutes from the time it arrived at the loading point until loading commenced, the driver being under instruction to return to the garage.

N. C. Officer Acts as Truck Dispatcher

At all loading points where much transportation was required, a non-commissioned officer was stationed, as an assistant truck dispatcher. It was his duty to anticipate the transportation requirements and requisition additional equipment in time to handle the business. He also superintended the loading of the vehicles to see that the cargo was properly distributed and that the vehicles were not overloaded.

Now a word as to the personnel. A driver is assigned to a particular vehicle, and he and the vehicle become as one part of the organization. The driver is responsible for the appearance of his vehicle and for its proper operation.

Each driver is supplied with two forms, identical in their composition, except one is green and one red. The green tag is to be hung on the car or truck upon turning into the garage with a notation of repairs needed, due to fair wear and tear. The red tag is used to cover repairs needed as the result of an accident. This latter tag is used to facilitate and insure getting all data necessary to complete the case, and is filed with the driver's accident report.

On the 1st, 10th and 20th of each month vehicles and men are lined up for inspection. The vehicles are thoroughly oiled and greased at this time, and such minor repairs as are necessary are made.

Vehicles Reduced—Cargo Tonnage Tripled

The number of vehicles necessary for cargo transportation has been reduced from 300 to 200, while the total tonnage of cargo hauled has been trebled.

Some of the activities covered by the army motor service can be seen when it is stated that mail, records, office furniture, silver bullion, commissary and ordnance supplies, ammunition, men, and wounded soldiers are transported by motor trucks and buses. One order alone comprised 7,000 tons of draft records.

The postal service in December, 1917, was unable to deliver all of its parcel post matter until five weeks after Christmas, while in 1918 the army motor service detailed 35 light delivery trucks on December 1 for this purpose, and all parcel post matter was delivered by the close of business December 26.

In the recent race, through the rapid transfer of personnel by means of motor trucks, these disturbances were handled by one-half the men that would have been required prior to 1917.

In connection with the operation of motor vehicles, the study of highways and the routing of transportation over these highways forms no small part of the activities of the operations division. The convoy branch is now compiling maps of the main highways of the United States showing the character and condition of the road and control points for night stops, where such controls are already established.

The traffic control branch is working out a uniform system of marking of roads which it proposes to submit to the various states, through the highways transport committee of the Council of National Defense, in a few days.

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Peace-Time Function of Corps

The Motor Transport Corps contemplates as one of its peacetime functions, in addition to its regular military duties, to distribute information relative to the cost of operation and maintenance of motor vehicles and to assist the commercial world in the selection of vehicles by types best suited to the cargo to be hauled. In this connection, do not misunderstand me to mean that the Motor Transport Corps will tell a man that such and such a make of truck is the one he should use. It will rather study the class of cargo to be hauled, the roads over which it will pass, and say that a two-ton or three-ton truck is best suited for the purpose.

I believe that the ultimate economic operation of motor vehicles from a commercial standpoint will eventually develop a co-operative scheme, possibly through a chamber of commerce or an automobile club, whereby initiation fees will be devoted to the purchase of new equipment and the dues will be fixed on a mileage usage basis. This would result in a minimum number of vehicles working at maximum efficiency; it would solve the problem of return loads, and reduce the cost of overhead and maintenance by reducing the number of garages and service stations. It is just a thought of future development that I leave with you.

I should also like to add that the development of highways is purely an engineering proposition. I am often appalled at the lethargy displayed by the engineering societies while the American Institute of Architects and other institutions are putting forth for roads. The development of motor transportation and highways is purely an engineering proposition and we should not wait to have the American Institute of Architects do it for us. I praise them for their foresight in doing what they have done, but I think the engineers' clubs throughout the country should get behind this road-building proposition. It is one of the foremost economic factors of our life today, and the development of motor transportation depends absolutely on the development of highways keeping pace with it. You cannot operate a motor truck economically if you have to go over bad roads.

Possible Shortage of Rubber Impending

Among other things, a world shortage of rubber was predicted by the chairman of Harrisons & Crosfields, Ltd., London, who in his annual address dealt with the production of rubber and gave interesting details of world production and consumption. He pointed out that in 1918 he had predicted, subject to there being no artificial restriction of output, that the production in 1919 of plantation rubber would be 314,000 tons; for 1920, 354,000 tons; in 1921, 381,000 tons; in 1922, 403,000 tons; and in 1923, 430,000 tons; that in 1917 the world's consumption of rubber was 255,000 tons, 52,000 tons of which were derived from sources other than the east. After allowing for the accumulated crop of 1918, which was exported from eastern countries in 1919, he estimated the plantation production for the present year will reach 320,000 tons; with 40,000 tons of wild rubber, the aggregate for the year will therefore total 360,000 tons. As to subsequent years he did not revise the estimates he gave on the previous occasion except that in 1920 production will probably reach between 360,000 and 370,000 tons.

Concerning consumption, the chairman stated that the United States has imported over 150,000 tons during the first eight months of the current year, and the total for the 12 months would aggregate about 220,000 tons. Against this the net imports of the United Kingdom were only 40,000 tons, which he estimated would meet the year's consumption. France took 14,500 tons in the first six months and for the year may need 30,000 tons. Italy's requirements he estimated at 15,000 tons; Canada, 10,000 tons; Japan, a similar amount; and, allowing 25,000 tons for the rest of the world, the total consumption would reach 350,000 tons, against a production of 360,000 tons. He pointed to the increasing demands and needs of the United States for the raw product, comparing it with the lower requirements of the United Kingdom. He concluded by expressing the opinion that, owing to the greater use of rubber for transport vehicles as well as for new purposes, the rubber industry is likely to be faced with a shortage of raw material rather than of oversupply.

Sweden Developing Shale Oil Deposits

During the war there was such a shortage of oil and oil products all over the world that it is not surprising to note that Sweden is to begin developing her shale deposits. The quantity of shale contained in the alum-shale deposits of South Sweden is estimated at 5,250 million tons, which, assuming a crude-oil yield of 3 to 4 per cent, represents some 144,000,000 tons of crude mineral oil. Sweden's requirements, which now amount to about 25,000 tons of lubricating oil per annum, will probably therefore be covered for some years to come.

In Germany, prior to the outbreak of war, shale was worked in the Rhine provinces and near Reutlingen, but only one company was occupied in converting shale into kerosene and mineral oils. From the bituminous shale which occurs near Messel (and contains 40 to 45 per cent of water, 6 to 10 per cent of tar and 40 to 50 per cent residues) the following are obtained from one ton of shale. 36 gal. of crude oil, together with 78 gals. of ammonia water and 2,100 cu. ft. natural gas, which is burnt as fuel in gas engines or under the vertical retorts. During the war the oil-shale deposits in South and North Germany have been investigated as regards their yield, but the results have not yet been published.

Automobile Body School Reestablished

When the Technical School for Automobile Body Makers and Draftsmen in New York City closed its doors in 1918 it was a great disappointment to many men in the trade who were graduates or who wished to study there. To all such comes the good news that the school has reopened in Detroit as a part of the Cass Technical High School.

It is conducted about the same as it was in New York with day and evening classes. These are free to residents of Detroit, but a fee will be charged to others. For further information address, Automobile Body Course, care Cass Technical High School, Detroit, Mich.

The course will be under the supervision of Andrew F. Johnson, who was the head of New York school.

Exports of airplanes and parts in October were worth $53,871, as compared with $791,062 in October, 1918. This amount covers principally parts, as there were but three planes included in the former figure and one in the latter.

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Motor Gasoline Specifications Revised

Committee on Petroleum Specifications Reports New End Point, Higher 90 Per Cent Point, and Elimination of All Gravity References—Test Methods

WHILE the average person driving a car, boat, truck or motorcycle might say that he was not interested in the technical specifications for motor fuel, the fact is that he is or must be vitally interested, for these specifications change the quality of the fuel he will buy and use in his car, boat or other automotive vehicle, and if the changes are so radical that his motor or carbureter will not handle the new fuel, he will not be able to operate the vehicle at all.

Similarly with the manufacturer; he must keep posted on the up-to-date fuel specifications, for his carburetion system must be designed and constructed to use the fuel which is being sold, not the theoretical fuel of the past, nor for that matter the possible fuels of the future.

All of which leads to the simple statement that the specifications were changed recently, this change being effective November 25, 1919. The Nebraska and Florida state specifications automatically changed to these new requirements, and other states which have standard specifications will change as quickly as possible.

As to the practical effect of the changes which are given in detail herewith, the raising of the end point will carry over heavier portions of the crude oil than came over previously, and will have the general effect of making the fuel slightly heavier, and, of course, vaporizing at a slightly higher temperature. This will make starting a little slower and heating more necessary than ever.

Early in 1919 the oil trade represented to the committee on standardization of petroleum specifications that the specifications of October, 1918, had become unnecessarily stringent and under existing conditions would, if universally adopted, unnecessarily restrict the total production of motor gasoline in this country. A change in specifications was requested.

The specifications adopted by the committee on standardization of petroleum specifications, October, 1918, under the U. S. Fuel Administration, promulgated in Bulletin No. 1, were drafted to cover federal purchases of motor gasoline for domestic and military uses, and represented a grade equivalent to the larger proportion of motor gasolines being marketed in this country in the calendar years 1917 and 1918. Although these specifications had been drafted solely for government use they were, nevertheless, voluntarily adopted by several states and municipalities as standards for the sale of motor gasoline. In recognition of the fact that whatever the intent or opinions of this committee the specifications were likely to be prescribed as standards in laws enacted by various legislative bodies to govern the sale of gasoline to the public, the committee deemed it advisable to propose only such specifications as would be reasonably satisfactory in use, and if adopted universally would not too greatly restrict the total available supply and thus be deterimental to the public good.

The committee was faced with the problem of determining what was a practical specification for motor gasoline, having regard to the total available supply and to satisfactory use in the motor. Obviously, both these factors are changing and it was fully recognized that the system of devising specifications must be flexible and permit revision from time to time as changing conditions of supply and use warranted. The difficulties of determining what was a satisfactory gasoline were also recognized. There could be no absolute standard because of varying conditions of use, such as engine construction and conditions, lubrication, climatic conditions, the personality of the driver, and many other elements, but the specifications could cover what experience had proved to be generally satisfactory under conditions as they exist today.

To obtain information on the subject the Bureau of Mines made a survey of the gasoline marketed throughout the entire country, and collected through its agents a total of 836 samples, covering practically all the types of gasoline produced and sold. Samples were obtained in every state, and included the products of all refineries of sufficient size to be of importance in the aggregate supply. The data collected in this survey are believed to be the most comprehensive now available with regard to the grades and quality of motor fuel now on the market.

The President, under date of July 31, 1918, issued an order which provided that the functions, power and duty of preparing and adopting specifications for the supply of petroleum and its products to any and all departments, bureaus, agencies, and offices of the government be transferred to and exercised by the United States Fuel Administrator. The United States Fuel Administrator shall exercise such functions, powers and duties through a committee of standardization of petroleum specifications which shall be composed of the following members: A chairman, who shall be appointed by the United States Fuel Administrator; one member who shall be apopinted by the Secretary of War; one member who shall be appointed by the Secretary of the Navy; one member who shall be appointed by the chairman of the shipping board; one member who shall be appointed by the director general of the railroad administration; one member who shall be appointed by the director of the bureau of mines; and one member who shall be appointed by the director of the bureau of standards. The specifications so prepared and adopted shall be binding upon and govern all departments, bureaus, agencies and offices of the government. It shall further be the duty of the United States Fuel Administrator, acting through said committee on standardization, to take all proper means to bring about a standardization of petroleum specifications for the purchases in the United States of the allied governments.

This order shall be and remain in full force and effect during the continuance of the present war, and for six months after the termination thereof by the proclamation of a treaty of peace, or until amended, modified, or rescinded.

Committee and Its Advisors

The committee on standardization of specifications for petroleum products is composed of the following: M. L. Requa, chairman; H. H. Hill, appointed by the director of the bureau of mines; Admiral R. S. Griffin, appointed by the Secretary of the Navy; Captain F. M. Sanderson, ap-

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pointed by the Secretary of War; Dr. C. W. Waidner, appointed by the director of the bureau of standards; Dr. H. L. Doherty, appointed by the chairman of the shipping board; and C. B. Young, appointed by the director general of the railroad administration.

Acting as technical advisors to this committee were the following: Dr. G. W. Gray, representing M. L. Requa, chairman; Commander H. A. Stuart, representing Admiral R. S. Griffin, appointed by the Secretary of the Navy; Capt. Sanderson, appointed by the Secretary of War; H. H. Hill, appointed by the director of the bureau of mines; G. A. Kramer, representing Dr. C. W. Waidner, appointed by the director of the bureau of standards; Dr. M. E. McDonnell, representing C. B. Young, appointed by the director general of the railroad administration; and Dr. R. G. Griswold, representing H. L. Doherty, appointed by the chairman of the shipping board.

With the data of the Bureau of Mines, which represented the results of the tests of a total of 836 samples of gasoline collected throughout the country, the technical sub-committee on the standardization of petroleum specifications met in the conference room of the Bureau of Mines, on Monday, September 29, 1919, to consider recommending a change in the specifications of motor gasoline and to consider lubricating oil specifications. The result of this meeting was to recommend back to the committee on standardization of petroleum specifications the adoption of the methods of tests and specifications as hereinafter indicated.

A public invitation was extended to all interested representatives of the trade to be present at an informal meeting of the sub-committee at 10:30 a. m., September 29, 1919. The meeting was held for the purpose of discussing the proposed revision of the old recommendations and receiving such suggestions as might be offered from the trade.

The committee on standardization of petroleum specifications, after considering the report of the technical subcommittee, approved its findings, whereupon the committee on standardization of petroleum specifications adopted the methods of test and specifications on the commodities as shown below in full.

Those members of the committee who gave their approval were as follows: H. H. Hill, Admiral R. S. Griffin, Capt. F. M. Sanderson, Dr. C. W. Waidner and H. L. Doherty. Not voting: C. B. Young.

Preliminary Changes

1. The end point of gasoline to be raised to 225 deg. C. (437 deg. F.).

2. The 90 per cent point of gasoline to be raised to 190 deg. C. (374 deg. F.).

3. The reading at the 45 per cent point to be replaced by the reading at the 50 per cent point, and the temperature raised 5 deg. C. (9 deg. F.).

4. All reference to gravity to be eliminated from all specifications for lubricating oils.

Revised Specifications for Motor Gasoline

Quality—Gasoline to be high grade, refined, and free from water and all impurities, and shall have a vapor tension not greater than 10 lbs. per sq. in. at 100 deg. F. temperature, same to be determined in accordance with the current "Rules and regulations for the transportation of explosives and other dangerous articles by freight," as issued by the Interstate Commerce Commission.

Inspection—Before acceptance the gasoline will be inspected. Samples of each lot will be taken at random. These samples immediately after drawing will be retained in a clean, absolutely tight closed vessel and a sample for test taken from the mixture in this vessel directly into the test vessel.

Specifications:

(a) Boiling point must not be higher than 60 deg. C. (140 deg. F.).

(b) 20 per cent of the sample must distill below 105 deg. C. (221 deg. F.).

(c) 50 per cent must distill below 140 deg. C. (284 deg. F.).

(d) 90 per cent must distill below 190 deg. C. (374 deg. F.).

(e) The end of dry point of distillation must not be higher than 225 deg. C. (437 deg. F.).

(f) Not less than 95 per cent of the liquid will be recovered in the receiver from the distillation.

Test—100 cubic centimeters will be taken as a test sample. The apparatus and method of conducting the distillation test shall be that adopted by sub-committee XI of committee D-1 of the American Society for Testing Materials (*), with the following modifications:

First: The temperature shall be read against fixed percentage points, and, Second: the thermometer shall be as hereinafter described:

Flask

The flask used shall be the standard 100 c.c. Engler flask, described in the various textbooks on petroleum. Dimensions are as follows:

Dimensions.	Cm.	In.
Outside diameter of bulb	6.5	2.56
Outside diameter of neck	1.6	0.63
Length of neck	15.0	5.91
Length of vapor tube	10.0	3.94
Outside diameter of vapor tube	0.6	0.24

Position of vapor tube, 9 cm. (3.55 in.) above the surface of the gasoline when the flask contains its charge of 100 c.c. The tube is approximately in the middle of the neck. The observance of the prescribed dimensions is considered essential to the attainment of uniformity of results.

The flask shall be supported on a ring of asbestos having a circular opening 1¼ in. in diameter; this means that only this limited portion of the flask is to be heated. The use of wire gauze is forbidden.

Condenser and Thermometer

The condenser shall consist of a thin-walled tube of metal (brass or copper) ½ in. internal diameter and 22 in. long. It shall be set at an angle of 75 deg. from the perpendicular and shall be surrounded with a cooling jacket of the trough type. The lower end of the condenser shall be cut off at an acute angle and shall be curved down for a length of 3 in. The condenser jacket shall be 15 in. long.

The thermometer shall be made of selected enamel-backed tubing having a diameter between 5.5 and 7 mm. The bulb shall be of Jena normal or Corning normal glass; its diameter shall be less than that of the stem and its length between 10 and 15 mm. The total length of the thermometer shall be approximately 380 mm. The range shall cover 0 deg. C. (32 deg. F.) to 270 deg. C. (518 deg.

*American Society for Testing Materials, Year Book for 1915, pp. 568-569; or pt. 1, Committee Reports, 1916, vol. 16, pp. 518-521. See also Bureau of Mines Technical Papers Nos. 166 and 214.

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F.), with the length of the graduated portion between the limits of 210 to 250 mm. The point marking a temperature of 35 deg. C. (95 deg. F.) shall not be less than 100 mm. nor more than 120 mm. from the top of the bulb. For commercial use the thermometer may be graduated in the Fahrenheit scale.

The scale shall be graduated for total immersion. The accuracy must be within about 0.5 deg. C. The space above the meniscus must be filled with an inert gas, such as nitrogen, and the stem and bulb must be thoroughly aged and annealed before being graduated.

Source of Heat in Gasoline Distillation

The source of heat in distilling gasoline may be a gas burner, an alcohol lamp or an electric heater.

Procedure in Conducting Distillations

1. If an electric heater is used it is started first to warm it.

2. The condenser box is filled with water containing a liberal portion of cracked ice.

3. The charge of gasoline is measured into the clean, dry Engler flask from a 100 c.c. graduate. The graduate is used as a receiver for distillates without any drying. This procedure eliminates erorrs due to incorrect scaling of graduates and also avoids the creation of an apparent distillation loss due to the impossibility of draining the gasoline entirely from the graduate.

4. The above mentioned graduate is placed under the lower end of the condenser tube so that the latter extends downward below the top of the graduate at least 1 in. The condenser tube should be so shaped and bent that the tip can touch the wall of the graduate on the side adjacent to the condenser box. This detail permits distillate to run down the side of the graduate and avoids disturbance of the meniscus caused by the falling of drops. The graduate is moved occasionally to permit the operator to ascertain that the speed of distillation is right, as indicated by the rate at which drops fall. The proper rate is from 4 to 5 c.c. per minute, which is approximately two drops a second. The top of the graduate is covered, preferably by several thicknesses of filter paper, the condenser tube passing through a snugly fitting opening. This minimizes evaporation losses due to circulation of air through the graduate and also excludes any water that may drip down the outside of the condenser tube on account of condensation on the ice-cooled condenser box.

5. A boiling stone (a bit of unglazed porcelain or other porous material) is dropped into the gasoline in the Engler flask. The thermometer is equipped with a well-fitted cork and its bulb covered with a thin film of absorbent cotton (preferably the long-fibered variety sold for surgical dressing). The quantity of cotton used shall be not less than 0.005 nor more than 0.010 g. (5 to 10 milligrams). The thermometer is fitted into the flask with the bulb just below the lower level of the side neck opening. The flask is connected with the condenser tube.

6. Heat must be so applied that the first drop of the gasoline falls from the end of the condenser tube in not less than five or more than ten minues. The initial boiling point is the temperature shown by the thermometer when the first drop falls from the end of the condenser tube into the graduate. The operator should not allow himself to be deceived as sometimes (if the condenser tube is not dried from a previous run) a drop will be obtained and it will be some time before a second one falls; in this case the first drop should be ignored. The amount of heat is then increased so that the distillation proceeds at a rate of from 4 to 5 c.c. per minute. The thermometer is read as each of the selected percentage marks is reached. The maximum boiling point or dry point is determined by continuing the heating after the flask bottom has boiled dry until the column of mercury reaches a maximum and then starts to recede consistently.

7. Distillation loss is determined as follows: The condenser tube is allowed to drain for at least five minutes after heat is shut off, and a final reading taken of the quantity of distillate collected in the receiving graduate. The distillation flask is removed from the condenser and thoroughly cooled as soon as it can be handled. The condensed residue is poured into a small graduate or graduated test tube and its volume measured. The sum of its volume and the volume collected in the receiving graduate, subtracted from 100 c.c. gives the figure for distillation loss.

Oil Production and Consumption in October

As the automotive industry depends wholly upon a supply of liquid fuel, the statistics of production and consumption, as given out by the government from month to month, are of absorbing interest.

The production of petroleum in the United States in October, 1919, thus stated, amounted to approximately 33,319,000 barrels, a decrease of 348,000 barrels compared with that in September, 1919. The average daily rate of production in October, 1919, was 1,074,808 barrels, which was less by 47,425 barrels, or about 4 per cent, than in the preceding month. However, the production in October, 1919, was greater by 2,064,000 barrels, than in October, 1918. All the fields, except Illinois, shared in the general falling off in the daily average production.

The consumption during the month totalled 34,989,000 bbls., an average of 1,128,677 bbls. per day. This, compared with September, shows an increase of 1,986,000 bbls. As production indicates a decrease this amount had to come out of the stored supplies.

The figures for the latter indicate that the total at the end of October was 135,461,000 bbls., compared with 137,131,000 at the end of September.

In connection with these figures, it is of interest to note that the production figures per month rose steadily from the early part of the year until the maximum was reached in July. Since then the decrease has been very small, but continuous. Consumption varied up and down, with a very sudden rise from July to August, in which month the maximum was reached. This was 37,488 000 bbls. With gradually increasing production and variable consumption, the stocks slowly increasd up to July, when it reached its maximum at 149,093,000.

Imports exceeded exports each month, the total excess for the 10 months being 39,745,191, as compared with an excess in 1918 of but 26 058,385 bbls. The total production exceeded the total consumption for the 10 months by 8,599,000 bbls., which would have been sufficient fuel for about 220,000 additional motor cars, figuring on the basis of 400 gals. per car per full year and a 20 per cent recovery of gasoline from the crude oil. From this it is apparent that with careful management even the present low grade of fuel will go a considerable ways toward meeting the increased demands of 1920, that is to say, without lowering the quality so as to produce a greater quantity from the same amount of crude.

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Aero Show in March, a Commercial Display

When the Manufacturers' Aircraft Association holds its second annual aeronautical exposition at the 71st Regiment Armory, 34th street and Park avenue, New York, in March, 1920, the public will have an opportunity to see what American designers have accomplished in developing commercial airplanes—planes for private use, for sporting or touring purposes, or long distance transportation of freight and mail.

The airplane owes its development principally to the war. Since hostilities ceased, however, American manufacturers have concentrated their efforts on planes for pleasure, sport and commercial uses. The exhibits will represent all producing airplane factories in the United States. Many of the planes are already assembled and in daily flights. Some of the larger ones are carrying mail between principal cities.

The larger planes have a carrying capacity of from 3,000 to 6,000 pounds and, driven by three or four motors, will cover half the distance across the United States in a single flight. The cost of operating airplanes has been reduced during the last year until now it compares favorably with motor trucks and railroads.

Chicago Meeting of S. A. E. During Show

The meeting of the Society of Automotive Engineers devoted to the discussion of truck and tractor subjects will be held in Chicago at the Hotel LaSalle on January 28, the Wednesday of show week. There will be professional sessions both morning and afternoon, and the big dinner that evening in the grand ballroom.

Among the papers tentatively scheduled for presentation at the Chicago meeting are the following: "Design of Pneumatic-tired Trucks," by P. W. Litchfield; "Decreasing Unsprung Weight by Use of Aluminum," by A. H. Edgerton; "Effect of Tire Equipment on Truck Design," by S. V. Norton; "Standardization of Military Tractor Engines," author to be announced; "Tractor Testing for Rating Purposes," by Prof. L. W. Chase.

National Tractor Show Date Changed

The date of the national tractor show, originally set for the week of February 9, has been changed to the week beginning February 16. This change was made by the Kansas City Tractor Club to avoid the conflict with the Wichita Tractor and Thresher Club's show, scheduled for the same time. This arrangement will make it possible for tractor manufacturers to exhibit at Minneapolis, Wichita and Kansas City, as the Minneapolis display occupies the week beginning February 2.

No Big Tractor Demonstration in 1920

The National Implement and Vehicle Association, at a recent meting held in Chicago, decided not to conduct nor sanction any big national or regional tractor demonstrations, such as were held in Kansas, Minnesota, Denver, Sacramento and Aberdeen during 1919.

More than simply withholding sanctions for these contests, the members do not participate in unsanctioned events, so that means that there will be no demonstrations. The association will be neutral on the smaller, local, one-day demonstrations, which it is believed accomplish more for the farmer and the tractor industry than the bigger, more expensive events.

The Automotive Book Review

Fire Dept. Motor Apparatus Instruction. By Capt. Daniel A. Sullivan. Second edition, 100 illustrations, 6¾ x 10, paper, 96 pps. Civil Service Chronicle Press, New York, $2, by mail $2.15.

This is a complete technical description in language adapted to the fireman, of the 30 types of motor fire apparatus in use in the New York Fire Dept., by Capt. Sullivan for six years the instructor of the department automobile school. The initial chapter is entitled, Explanation of Elementary Principles of the Gas Engine, which explains the subject matter of these 11 pages. This is followed by The Component Parts of a Gas Engine, for a total of 16 pages. Next the individual pieces of apparatus are described from a gasoline engine point of view. This is not like any other book on gas engines ever written, but is a fireman's textbook, written for firemen, by a fireman, and from a fireman's point of view.

Side-Opening Heat-Treatment Furnace. Bulletin 200 sized and punched for binder. 8½ x 11, paper, 4 pps. W. S. Rockwell Co., New York.

This illustrates and describes in some details a new Rockwell furnace, which was developed to heat-treat material varying widely in size and shape. The furnace is 36 ft. wide and stock of this length may be used in it, or the interior partitioned off into individual chambers 5 ft. 9 in. wide or multiples. This unit has proved so advantageous that a new and larger one along similar lines and 105 ft. wide is being developed. This will permit annealing and heat-treating the largest shafts and similar pieces.

Wichitauk. New house organ of the Wichita Motors Co., Wichita Falls, Tex. 7⅜ x 10¼, 16 pps., including self-cover.

This company has increased in size, prestige and number of employes to the point where it is desirable to get out a house organ. The front cover is a very neat marine scene in dark blue and black. Two pages are given to the new Oklahoma City plant, another half page to its manager and his experience. Two pages are devoted to a talk on radius rods, really an exposition of the so-called Hotchkiss drive. The balance of the book is of a general nature. It is a splendid effort.

Sidelights on Aluminum and Non-Ferrous Metals. By L. M. Brile, Henry Hecht, and C. J. Wolfe. New, about 50 illustrations, 5¼ x 7½, paper, 154 pps. United Smelting & Aluminum Co., New Haven, Conn.

After a short description of the company and its progress, the subject of aluminum, and then of other nonferorus metals is covered very thoroughly. Mr. Brile has collected into one small, pocket-size booklet about all the information of this light metal that is worth having, or at least that is in every-day use. The various forms of the metals are described as well as the process for producing them, and the uses for each. About 40 pages are given up to useful tables, data and specifications, which no one interested in aluminum should be without. The chapter on babbitt is unusually good.

Experiments not yet completed at the Forest Products Laboratory indicate that the thickness of the glue line in plywood may vary considerably without noticeably affecting the shear strength. In heavier joint work, however, the thickness of the glue line apparently has much to do with the holding power of the joint.

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Vol. LXI DECEMBER, 1919 No. 9

Progress Toward National Highways

SENTIMENT throughout the country seems to be rapidly crystallizing into a favorable attitude toward a complete national system of highways, provided for in the national budget, of course. Thus, the Townsend bill which is before Congress and provided just that, that is complete governmental participation in highway construction and maintenance, is slowly winning countrywide support. The farmers have advised the National Grange of their overwhelming support of this measure, responses from local granges in 21 states favoring it in the ratio of 12 to 1. These replies range from Maine to West Virginia and as far west as Washington and Oregon.

The general idea expressed is that the government is big enough to take care of the national highway, and that it should do so as quickly and as economically as possible, this policy being the only one which will produce a national system of roads without overburdening the people who live on the roads.

City opinion is just as favorable to good roads the country over as is that of the country people. For instance, this editorial which appeared in the New York Evening Sun recently, under the heading Highways:

"As rail troubles keep on increasing the country finds more and more use for river, canal and highway. The growing value of the automobile as a freight carrier, in addition to its wide use for passenger travel, makes the state of our country roads a matter of prime interest. Highway Commissioner Grone announces that New York state roads will be increased by 172 miles in the coming year. Of the 725.50 miles to be constructed 527.26 will be of reinforced concrete. This is building for tomorrow, since this type lasts nearly half a century."

Here the underlying opinion is that the main arteries of road transportation are just as much a public utility and thus just as interesting to all the people, as the railroads or canals. This is proven in the case of the recent railway strike in England, where the strike was broken by means of motor transportation, the motors being applied as carriers to an established and highly specialized system of goods and passenger transportation.

The crying need for roads built by some governmental agency, particularly in the far west, was pointed out by the crew of Autocar engineers after their double transcontinental trip. They stated that the country has hardly made a beginning in developing good roads. West of the Mississippi the prevailing "good road" is one that is hard once in a while, with no consideration given as to what its condition may be after a rain. As bearing upon the Townsend bill and the situation which it is designed to correct, on one stretch of western road 80 miles long, the party found only three taxpayers.

Motoring an Effective Exercise

THE majority of people have come to look upon motoring as anything but exercise, in fact the majority of motorists and their friends have thought of it as doing away with exercise in that it replaced the former beneficial walking, cycling or other means of exercise and fresh air. A well known writer on scientific subjects, Dr. Henry Smith Williams, writing in a recent issue of Motor, takes exception to this general view and states that automobiling is beneficial and shows accruing benefits under three heads—physical, mental and volitional. He proceeds to point out that in addition to the exercise, the motorist has been in the open air, buffeting the winds, inhaling ample quantities of oxygen to meet the increased needs of the accelerated currents of blood corpuscles; and that digestion and assimilation are thereby facilitated and the toxic products accumulated through former inaction progressively are in increased measures oxidized and eliminated. The doctor supports his conclusions in part as follows: "It is the muscles of the arms, together with those of the chest and abdomen, that preeminently and habitually suffer. When you drive a car 40 or 50 miles over average American roads, or a fraction of that distance in the city, you give your arms and torso a course of purposeful calisthenics that redounds directly to the benefit of your muscles and arteries and heart and indirectly, but no less significantly, to the benefit of your digestive apparatus and organs of elimination as well as the nervous system."

If you stop to think of the long runs you have made, and how tired you were afterwards, how sleepy you were, and how long you slept afterward, you will immediately realize that Dr. Williams is pretty nearly right, no matter how radical it sounds at first.

Diesel Engine Opportunity in Shipping

PRESENT world prices offer an opportunity for the Diesel engine to prove its worth in marine work. According to the December issue of our esteemed contemporary Motorship, fuel oil is $10.50-$14 a ton here and $42.25 (190 kroners) in Christiana. On this basis, a 10,000-ton Diesel-engined freighter can come to New York on fuel from another ship, bunker 1,000 tons of fuel oil, proceed to South America, discharge cargo and take another back to Christiana, and have 500 tons of bunker oil left. The sale of this will leave a profit of $8,000, so that a Diesel-engined freighter can show a profit on operating, regardless of cargo.

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Welding Wrought Iron and Steel

By H. L. UNLAND*

Equipment, Materials, Fluxes and Their Uses—Preparation of the Weld—Use of Metallic and Carbon Electrodes—Welding Cast Iron and Other Metals

THE welding of wrought iron and steel in simple sections by the electric arc welding process presents no serious difficulties. Reasonable care on the part of the operator in keeping the weld clean and in the preparation of the weld will, with ordinary skill in welding, result in a successful weld.

The subject of welding may be divided into three steps:

First—Equipment and Materials.

Second—Preparation of Weld.

Third—Welding.

Equipment and Materials

In addition to the equipment and auxiliary apparatus, special jobs render it desirable to have on hand other miscellaneous pieces of equipment.

Odd pieces of carbon block or of copper are of much assistance as dams in holding the molten metal in place. In cases where the weld must be smooth on one side, a

Fig. 7—Locomotive cab welded throughout—This bears a strong similarity to a motor truck cab and the method would be equally useful

piece of copper or carbon is held against the weld and metal filled against it. Iron or steel can be used if care is taken not to weld to it.

In filling a hole the bottom is often closed by holding a plate of carbon or copper against it until sufficient metal is filled in to hold.

Care should be taken to flow the molten metal against the guide pieces and not to allow the arc to play directly on them. Otherwise the weld will probably be contaminated by this material, or else the guide piece may be welded solid and cannot be easily removed.

A steel wire scratch brush is used to remove light scale and rust before commencing to weld, if necessary, and also at intervals during the welding, usually when changing electrodes.

For small work the positive lead may be bolted to an iron plate forming the top of a work bench. The work may be set on this bench, the contact being sufficient to carry the current. In many cases a vise mounted on the table will be found desirable. If the work is too large for the table it may be set beside the table and a bar laid across to it. This will provide sufficient current-carrying capacity, provided scale and rust do not entirely prevent contact. The rails in a round house, if bonded, are usually connected to the positive lead and any car on these tracks may be welded by running only the cable leading to the electrode, the return cable being unnecessary since the current will be carried back through the rails.

A convenient terminal for the positive cable consists of a copper hook of proper size to which the cable is bolted. The terminal may be laid on the work or hooked on a projecting part. It is seldom necessary to actually clamp the return lead to the work unless the metal is thickly covered with scale or dirt which acts as insulation, in which case it is easier to chip or brush off a clean place for the contact than to use a clamp.

If welding is to be done in a room where other employes are doing other work, screens should be provided around the welding operator. They should be high enough to prevent the light striking a large part of the ceiling, since the flicker of this light would probably affect the other workmen. The effect, while probably not injurious, would be irritating. White walls and ceiling should be avoided in a welding room.

Gas burners for preheating and fire brick, sand, or sheet asbestos for covering are useful, especially for cast iron work, which in many cases should be preheated uniformly to a red heat and welded while at this temperature. A receptacle of water is desirable, in which the electrode holder can be cooled when it becomes too hot after continued use.

Some operators feel that gloves are necessary to protect the hands from the arc. In many cases, however, operators find gloves to be in the way, especially when working with the metallic electrode. If desired, however, any leather or cloth glove will give sufficient protection to the skin of the hands which is much less sensitive than the skin on other parts of the body. The arms, neck, and face should, however, be covered, since exposure of these parts will probably result in burns similar to sunburn, which, while painful, are not serious.

No Flux Needed If Work Is Clean

It is the experience of a great majority of welders that flux of any kind is unnecessary in welding, and further that it is a source of danger in that there is liability of contaminating the weld. If the work is kept clean by brushing at frequent intervals and ordinary care is taken in the operation of the arc a good weld can be made with-

* Power and Mining Engineering Dept., General Electric Co. See also article, "The Electric Arc Welding Process," in October issue.

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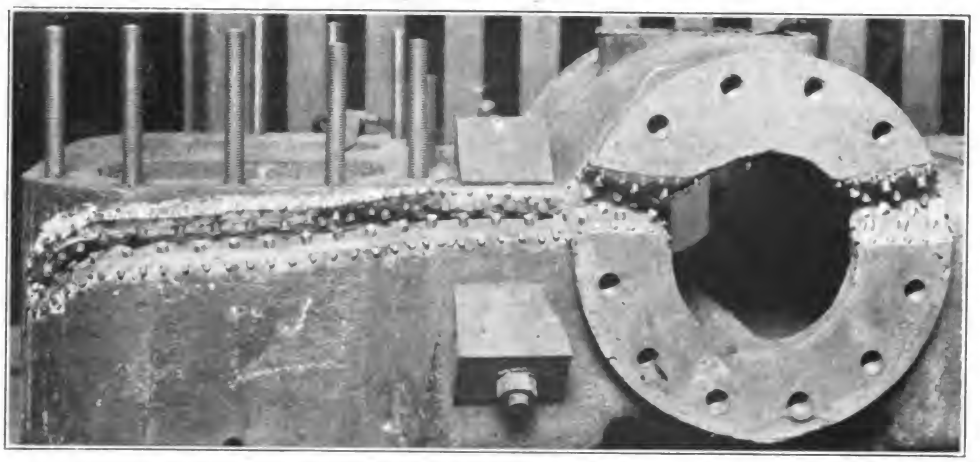

Fig. 8—Broken cast iron pump, showing method of preparing the surfaces for bare arc welding

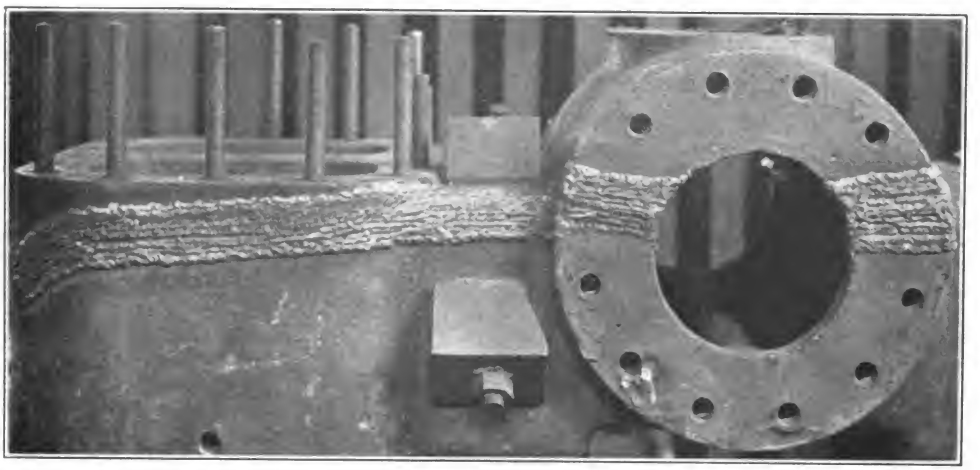

Fig. 9—The broken pump surface as welded with bare electrode, and showing how the new material was built into place

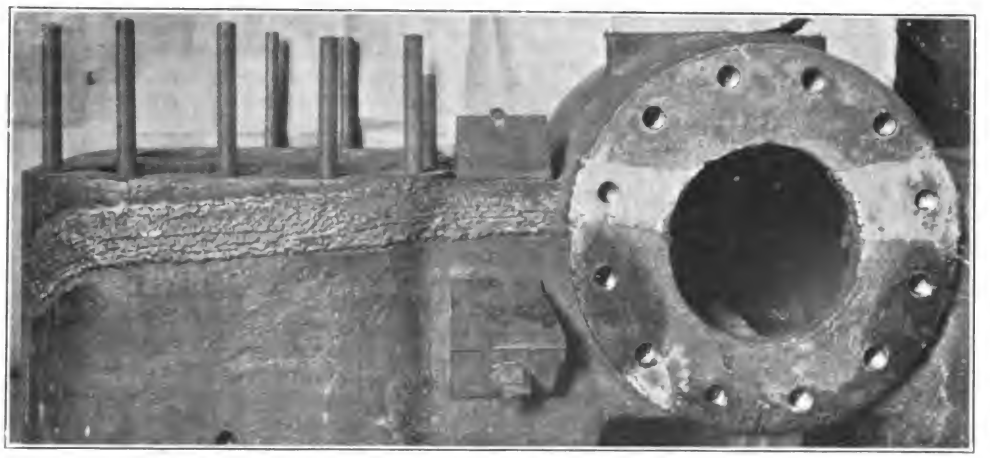

Fig. 10—Final appearance of the welded pump, indicating the removal of the welded metal from the head where the valve seats

out flux, and if these attentions are lacking flux will not make a good weld.

Preparation of Weld

Metal that is clean is much more likely to make a good, strong weld. Scale, rust, grease, soot, and foreign matter will contaminate the weld, and such inclusions necessarily weaken it or else make it hard. Impurities may also make the metal porous and spongy due to liberation of gas. Pieces of foreign matter may prevent the molten metal filling all parts of the weld and cause cavities.

Various methods for cleaning are in use—pickling for small parts, washing with gasoline or lye, boiling with lye, sand blasting, chiseling, scratch brushing, etc., the method depending on the local conditions.

Preparatory to welding locomotive tubes to the sheets it is sometimes advantageous to send the locomotive out on a run to burn off the grease and then clean off the oxide and soot by sand blast. Another method is to heat the boiler to normal by steam pressure and then clean by sand blasting or scratch brushing.

In welding heavy sections where it is necessary to deposit several layers of metal, the surface of the preceding layer should always be cleaned before starting the next.

When sections of ⅛ in. or less in thickness are to be joined, the edges need not be beveled but they should be separated a small amount. Thicker sections should have the edges beveled to give a total angle of 60 deg. as well as separated by ⅛ in. In some special cases angles as low as 30 deg. may be necessary and as high as 90 deg. may be used, but an average safe value is 60 deg. Still heavier sections may be beveled from both sides and the eld made from both sides. In the latter case a layer should be put on one side and then a layer on the other to prevent warping.

For long seams the edges should be ⅛ in. apart at the end where the weld is started, and at the far end the space should be ⅛ in. plus 1½ per cent of the length. This takes care of the expansion of the metal in the sheet and of the contraction of the metal in the weld as it cools.

Another method of reducing expansion is to put in short sections at intervals, welding in one layer at a time, starting at the center and working alternately toward either end. Then put one layer in the open sections, and continue in the same way till the weld is completed. The welded section of any layer should not match those in the layer below or above, the joints being broken.

The welding of complicated shapes such as flywheels and some castings may require preheating at certain points

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to produce initial expansion which will be overcome as the weld cools. In some cases the entire piece must be preheated and in some cases after welding the whole piece must be annealed. This is sometimes done by heating the piece uniformly and then covering it with sand, asbestos, etc., and allowing it to cool slowly.

In welding cracks in plates, forgings, or castings the crack should be chiseled out to get a good bevel entirely through the plate, with ⅛ or 3/16 in. clear opening on the back or to the bottom of the crack in castings or forgings. In boiler work ½ in. holes are sometimes drilled well beyond the ends of the crack and the crack chiseled, beveled and welded.

Welding With the Metallic Electrode

The arc should be kept short, not over ⅛ in. in length.

The current should not be greater than those indicated in the table for the electrode diameter. Excessive current causes burnt or porous metal to be deposited.

The arc should be kept constant in length to insure uniformity in the metal deposited.

In welding a seam the electrode should be moved in a zigzag or circular path advancing along the seam. The metal will adhere only to the surface on the work actually played on by the arc, so care must be used to bring the arc in contact with the whole surface to be welded.

Be sure the electrode is connected to the negative terminal. If the polarity is reversed the arc will be more difficult to maintain and the deposited metal will not be as good as it should be.

In starting the arc the electrode should be just touched to the work and withdrawn immediately to the required distance. If the electrode is held too long in contact it will weld to the work, causing some delay in freeing it and starting over.

In welding be sure that the arc plays over the entire surface of the joint. The metal of the work is fused by the direct impact of the arc and if molten metal merely runs ahead of the arc over the solid metal of the work it will not result in a weld.

The metallic electrode used is generally from 14 to 18 in. long. It may be gripped in the holder, either at one end or in the middle as required by the skill of the operator or the nature of the work.

The operation of welding overhead is the same as in normal welding. The difficulty largely lies in holding the electrode steady in the cramped position usually required. If the arc length is kept constantly short the metal will be successfully deposited, and practice is required to accomplish this. The appearance of an overhead weld is sometimes marred by drops of metal projecting or by an uneven thickness of the deposited metal, but this can be overcome by proper manipulation of the electrode. A rest for the arm will sometimes assist the operator to hold the electrode steady.

The Use of the Carbon Electrode

The holder should grip the electrode from 4 to 5 in. from the end. The electrode should for ordinary work be tapered to a blunt point at the working end to keep the arc from wandering over the end of the electrode. As the electrode burns away with use, the holder is moved back along the electrode to keep length of working carbon constant. The burning away of the electrode will tend to keep the taper approximately constant.

The arc is struck in the same manner as with the metallic electrode, but a longer arc should be used; from 1 to 1½ in. is the average. The arc should not be too short when welding or depositing metal as there is danger of depositing carbon in the weld, with the probability of a hard weld resulting. In cutting, or melting off metal, the arc should be kept short, about ½ in. being an average length.

To cut (for which purpose the carbon electrode must be used) the arc is operated like a gas torch. It is held in one place long enough to fuse the metal and allow it to run off. For thin plates laid flat a hole is melted through by holding the arc on one spot, then the electrode is slowly advanced along the desired line, the molten metal dropping out below. For thick pieces, such as shafts, castings, etc., it is desirable to start at the top on one edge and work down allowing the molten metal to run down through the cut. It is often necessary to follow the molten metal down with the arc to keep it melted until it runs off.

The width of the cut will depend on the size of the

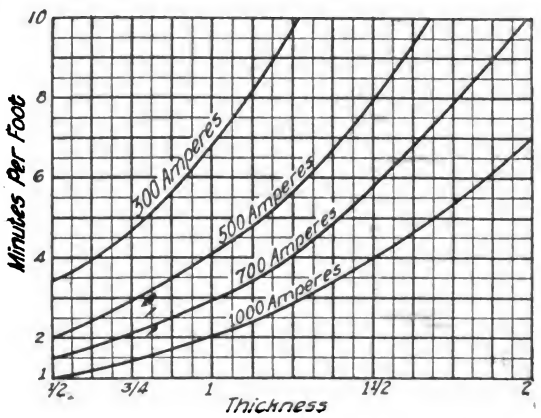

Fig. 11—Chart indicating carbon electrode cutting speed for various current strengths and metal thicknesses

electrode used and on the skill of the operator in keeping to a straight line. The cut will be slightly wider than the diameter of the electrode in order to allow the arc to be played on the bottom of the cut, and it will be wider for thick sections than for thin ones. The edges of the cut will not be smooth, due to masses of the molten metal not running away and also to the fact that the arc will tend to jump from one point to another and cause an uneven cut.

To deposit metal with the carbon electrode, the arc is struck as above, but is not held in one place long enough to melt through. A pool of molten metal is established and a melting rod of metal is fed into the arc and melted down on the work. It should all be heated thoroughly to insure complete union before more metal is added.

Since heavier current can be used with the carbon electrode than with the metallic, fatser work can be done in depositing metal. The quality of the weld is not quite so good, however, as when the metallic electrode is used. However, for filling holes in castings, building up worn spots, etc., the carbon weld is satisfactory and should be used.

Due to the high temperature and large amounts of heat liberated when using the carbon electrode, the electrode holder is liable to become very hot and under some conditions to melt away at the end. When the holder begins to get hot it should be plunged in a receptacle of water kept conveniently near the operator.

(Concluded on page 28)

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Some Australian Timbers for Coach Workers*

By J. E. BISHOP

What These Timbers Are, How and Why They Are Better for Coach Uses—Strength and Other Tests—Suitability for Various Work

IN connection with Australian timbers for use in coach work, a great deal of work has been done, first and last. Previous papers at conventions have added much to our knowledge of these timbers and their properties, especially of spotted gum. There was an inquiry by scientists in Sydney about 1895 into the merits of spotted gum, but the work done was poor in results. The best work on Australian timbers seems to have been done by American scientists. We hear a good deal about the superiority of American timbers as compared with those of Australia, but Americans speak in the same high terms of Australian products.

There is one Australian timber grown extensively in California. That is blue gum—Victorian and Tasmanian blue gum.

Baron Von Mueller about 60 or 70 years ago was greatly taken with this fine tree. He sent parcels of seed all over the world. One of the results is that in Egypt, Italy, France, Spain and the United States of America blue gum (eucalyptus globulus) is a familiar tree.

In America much work has been done on timber and various qualities have been investigated. At the Carriage Builders' National Association in 1906, one of the experts from the Forest Service in connection with the United States Department of Agriculture, spoke of carriage builders' timbers, and dealt with those specially suitable to carriage building. Among others he spoke of blue gum. He said, "It has a most rapid growth, probably the most rapid of the trees we have and the few tests we have made show it to be nearly equal to the best of hickory." So much for an American opinion.

Mr. Olding in his description of spotted gum said, "The qualities that were necessary for coachbuilders' timbers were: First, that it should be hard to resist the cutting in of bolts and clips; second, that it should not be easily broken or split; third, it must not be liable to rot; fourth, it must take the paint well; fifth, it must work well; sixth, it should have plenty of spring."

We accept this description of the qualities of timber as being most apt. They describe the situation. As to hardness; that raises the question, How hard? How do we estimate the hardness of timber? "Not easily broken or split." How easily broken or split? How are we going to judge this? "Plenty of spring." What does that mean?

In an endeavor to elucidate some of these points I want to bring under your notice the methods which the Americans and others have adopted to test these qualities in timber.

The tests published by the United States in 1906 included in those which I have referred to as having been submitted to the Carriage Builders' National Association, two Australian timbers. The modulus of rupture for sugar gum (a South Australian timber) was given as 25,344 lbs. This modulus of rupture is a purely hypothetical figure. It gives a standard by which we are able to compare the strengths of various timbers. The modulus for blue gum was given as 23,265 lbs.

Prof. Warren, of the Sydney University, made a large number of the tests. Among his results were:

Sugar gum modulus	10,300
Blue gum modulus	13,200

About half of what the same material showed in the United States.

Then Mr. Mann's tests, which were submitted to this association in 1904 or thereabouts, gave.

Sugar gum	9,700
Blue gum	15,500

Although the latter makes sugar gum much lower than the American tests, he makes blue gum much higher.

Against these I ask your attention to the following American tests for hickory. Pignut hickory is one of the best hickories that is grown, and the best test out of 30 showed a modulus of 25,000 lbs. and the worst test 11,100 lbs. Other results were: Shagbark, 16,000 lbs.; mochernut, 15,200 lbs.; water, 12,500 lbs.; bitternut, 15,000 lbs.; nutmeg, 12,500 lbs.; pecan, 15,300 lbs.; pignut, 18,700 lbs. These records put hickory much below blue gum. The best average for hickory was 18,700, against sugar gum, 25,344, and blue gum, 23,265.

When we see so many discrepancies we must come to the conclusion that there is something wrong with the data. The defect in all the Australian figures is that the investigators have not taken into consideration the effect that the presence of moisture has in timber. The timbers were not sufficiently seasoned.

Methods of research have advanced considerably since 1906. In 1917 the American Forest Service published a bulletin in which they gave the results of the 130,000 tests made on 126 different kinds of timber in commercial use in the United States. It is in regard to these that I wish to speak. They deal with nearly all the qualities, and the methods which we might use to get the answers to those questions which I asked in regard to the general description. It is fortunate for us that for the purposes of comparison they include blue gum.

I wish to bring under your notice the fine record which blue gum holds in comparison with hickory on all the tests. I have not sufficient time to go over all the matters. The table I have prepared shows important qualities.

Test No. 1 gives the moisture content when green and when dry. Test No. 2 shows weight per cubic foot, and Test No. 3 shrinkage both radially and tangentially. In regard to the elastic limit, I would like to give a short explanation. If you put a piece of wood on two supports and bend it in the middle there is a point from which it will completely recover. It comes back as much as you bend it. That is the elastic limit. You will agree that that material which you can bend most with the assurance that it is going to recover is the most elastic. Test No. 4 gives in pounds per sq. in. both with green and dry timber,

* Read before the Carriage Wagon and Motor Body Builders Association of Victoria Exhibition and Twelfth Annual Convention, Melbourne, Australia, September, 1919.

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	Blue Gum	Hickory Shellbark	Hickory Bitternut	Hickory Mochernut	Hickory Pignut	Hickory Shagbark
Test No. 1						
Moisture Content (per cent)						
When green	79	61	66	59	64	60
When air-dry	5.7	8.7	9.2	8.9	9.6	9.4
Test No. 2						
Weight per cubic ft. (lbs.)						
When green	70	63	63	64	64	64
When air-dry	54	48	46	50	53	50
Test No. 3						
Shrinkage from green to oven-dry (per cent of dimensions when green).						
In volume	22.5	19.2	....	17 9	17.9	16.7
Radial	7.6	7.6	....	7.8	7.2	7.0
Tangential	15.3	12.6	....	11.0	11.5	10.5
Test No. 4						
Static bending; fibre test at elastic limit (lbs. per sq. in.)						
When green	7600	5600	5500	6300	6200	5900
When dry	14400	9800	10300	13500	12700	11900
Test No. 5						
Modulus of Rupture (lbs. per sq. in.)						
When green	11200	10500	10300	11100	11700	11000
When dry	20600	20500	18800	21600	22500	22600
Test No. 6						
Modulus of Elasticity (x1000 lbs. per sq. in.)						
When green	2010	1340	1400	1570	1650	1570
When dry	2600	2040	1880	2380	2410	2290
Test No. 7						
Work done in bending to elastic limit (inch lbs. per cubic inch).						
When green	1.65	1.36	1.22	1.38	1.34	1.28
When dry	4.82	2.59	3.19	4.19	3.87	3.55
Test No. 8						
To maximum load (inch lbs. per cubic inch)						
When green	13.9	29.9	20.0	26.1	31.7	23.7
When dry	11.6	22.4	17.9	22.0	30.2	26.3

the fibre stress of the timbers at their elastic limits. Blue gum is superior in elasticity to any of the hickories. The dry blue gum is 14,400—just twice the stress dry compared with the green state.

The modulus of rupture is shown by Test No. 5. The results here given enable us to compare the strengths of various timbers. Only two of the hickories in the green state are stronger than the blue gum.

Another test is the work in bending beyond the elastic limit. The point in which hickory differs from all other timbers is in this. Supposing we mount a strip of hickory on two supports and apply pressure so that it will go down, say, 2 in., and it will come back 2 in. We would call that elastic within a range of 2 in. To put a piece of hickory down that 2 in. will take only about two-thirds of the weight required to put a piece of blue gum down the same distance. Both would recover. But if we put the blue gum down, say, 2½ in., it would still come back that 2½ in., while the hickory if put down 2½ in. would only come back 2 in. The blue gum will go further down within its elastic limit. Test 7 gives the comparative results. In every case the blue gum is superior to the hickory.

The next test, No. 8 in the table, that of the breaking point, is where hickory is superior to any other timber. It excels in the quality in which iron is superior to steel. Steel will go down further than iron within its elastic limit, and after passing its elastic limit instead of taking a permanent set it will break, but iron instead of breaking will go down further still but without power to recover. It is the same way with hickory. We speak of that quality as being evidence of its elasticity. It is really evidence of plasticity not elasticity.

According to the American tests blue gum is the most elastic timber of those submitted to the tests. That is a great compliment to Australian timbers.

The commonwealth military authorities here have prescribed certain tests for timber. Those who do this military work are asked to supply test pieces of timber 12 or 14 in. long and 1 in. square. These are put on two supports and broken in the middle. The breaking stress is specified. The specification in a recent test required iron bark 1 in. square and 16 in. long, supported at two places 12 in. apart and able to sustain a load of 1,000 lbs. The poorest of those submitted was at least 50 per cent over the test. The tests for blue gum and spotted gum gave better results. The least valuable of those pieces was 75 per cent above the tests.

Professor Warren's Tests on Mr. Olding's Samples

Species	Modulus of Rupture per square inch
Iron Bark (E. paniculata)	
No. 1	30,240
No. 2	28,260
No. 3	27,720
N.S.W. Blue Gum (E. Saligna)	
No. 1	23,520
No. 2	20,880
No. 3	22,800
Spotted Gum (E. maculata)	
No. 1	21,400
No. 2	22,500

All of these results are superior to any which Prof. Warren was ever able to get in his own elaborate report covering some hundreds of tests. He was never able to get any figures like those which were obtained from this timber, which had the tremendous advantage of being thoroughly dry. These good records may be attributed to the dryness of the wood. I think that the poor records obtained by Prof. Warren and others have been due to the unseasoned timber which they have handled. The other tests of New South Wales with blue gum and spotted gum show that they are superior to most of the hickories. Pignut hickory is the only one that gives a record above them.

All this goes to show that the research work done is very inadequate, and that something more is required to put us in the position of American manufacturers, when we are trying to answer those questions which I have suggested that we might ask in regard to the qualities of timber of coach building. The authorities in Australia should undertake research into the whole of our economic timbers. This is work beyond our resources. The universities have big machines which cost several thousands of pounds of public money, they are available to us only at about a guinea a test, we therefore cannot do that kind of research. There is much research that coach builders can do quite easily. The scientist differs from the ordinary man, not in that he sees more, but he records more of what he sees and classifies and draws inferences from what he records.

There appeared in the Coach Builder two months ago the results of an investigation by Mr. Patten, a Victorian government research scholar, into some common hard woods. It shows how simple are many of the processes by which scientists get at their far reaching conclusions. Tests, excepting for strength, are in the main simple matters of observation, recording and classifying. Mr. Patten wanted to determine whether timber stacked on end dried quicker than timber laid flat. He dried timber in both positions and weighed the samples at regular intervals, using similar pieces of timber in both experiments. The result was conclusive. Such tests are within the power of each of us to carry out. We have the opportunity of publishing our records which will be of great value to all engaged in our industry.

In the discussion which followed, Mr. Olding complimented Mr. Bishop on his address and said that his information carried the subject further and was particularly

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valuable at this stage in the history of Australia because we were all looking forward to our sons stepping in to the work which we had made our life work. The sons wanted to know from their fathers how they did certain things and how they got certain results and their reasons for rejecting certain timbers, and sometimes it was hard to put into words their reasons for doing these things. By the methods which Mr. Bishop had indicated their sons would be in a position to do better things than they had done in their easy going way. It had taken them years to train their eye to selecting timbers by looking at them. In the future a lot of this work would be done under inspectors, especialy any military work, and these tests would be necessary. He moved a vote of thanks to Mr. Bishop for his able address.

Mr. Hardie, who seconded Mr. Olding's motion, said that a good deal of experience was required to test timber and that in judging the qualities of timber quite a lot could be ascertained from the appearance of the timber that could not be brought out in the tests. He thought he could pick out by its appearance the timber that would best stand the tests. There was also to be considered the number of varieties in each class of timber, for instance, gray, white and red iron bark, and in each case there was a great difference in their respective strengths. And again the portion of the tree from which the particular piece of timber was taken—the outside—was very much tougher than what would be taken from nearer the heart. Another point that he would mention was in connection with the reafforestation of our blue gum in America. Seeds sent to America from Australia had not produced as satisfactory results as had been expected. The blue gum grown in America from the Australian seeds was a totally different timber to ours. This was probably due to soil and climatic conditions, etc.

W. H. Stevens supported the resolution. He had noticed during his travels in France, England and Scotland that timber, instead of being laid down or slatted, was stood on end after being cut, and he thought if this could be done here it would be of advantage. He also noticed that timber was often cut green in various directions and in different shapes from the actual trees, according to the fancy of the buyer. He did not think statistics proved anything and in his opinion hickory was the best material for a light flexible wheel, whereas, according to Mr. Bishop, nothing was finer than blue or spotted gum. He considered he could best judge the quality of timber by its weight. He agreed with Mr. Hardie that trees that gave good results in their own native countries did not produce the same results when transplanted to other countries.

Welding Wrought Iron

(Continued from page 25)

Cutting speed with the carbon electrode for various values of current strength and thicknesses of material will be approximately in accordance with the curves shown in Fig. 11.

Cast Iron Welding Unsatisfactory

This metal, due to its properties, is unsatisfactory for welding by any method. Its low strength and brittleness cause it to break from expansion and contraction strains unless precautions are taken, and even then a successful weld cannot be assured.

Pieces of simple cross section and heavy pieces present much less difficulty than complicated shapes, but due to the undependable nature of cast iron, care should be used in all cases.

The experience and skill of the operator are large factors in determining whether or not a given weld will be successful.

Welding Other Metals

By experimenting a number of operators have learned to weld copper to copper, copper to brass and steel, and bronze to bronze, as well as Monel metal, high-speed steel and Stellite. The special uses are rather limited in their application and the methods vary, so it is recommended that each operator experiment along the lines suggested by his experience.

Britain Now Manufactures All Ignition Units

In England an unusual situation with respect to ignition units has been created by the war. Previous to it the greater part of the ignition apparatus such as magnetos, spark plugs, etc., was imported and largely from Germany, the Bosch magneto, for instance, practically monopolizing the situation through the highly specialized manufacturing methods adopted and which had resulted in a very low priced magneto of unusual merit practically making competition impossible. The increased war demand for automotive vehicles and the cessation of German supplies brought a number of manufacturers into the field who have since combined under the title of British Ignition Apparatus Association, with the result that foreign competition is likely to be rendered difficult in the future. There is no Sherman Law in Great Britain.

The names of the firms in the association are: C. A. Vandervell & Co., Acton Vale, London; North & Sons, Ltd., Watford; the Thomson-Bennett Co., Coventry; P. N. L. Magneto Syndicate, Ltd., Coventry; Electrical Ignition Co., Ltd., Birmingham; British L. M. Ericsson Mfg. Co., Ltd., Beeston, Notts; British Thomson-Houston Co., Ltd., Coventry and Willesden; British Westinghouse Electric & Mfg. Co., Trafford Park, Manchester. Other concerns outside the association, including Vickers, Ltd., London, are also manufacturing magnetos.

More Road Repairs and Trucks for Tunis

The director of public works of Tunisia has given his assurance that the work of repairing and maintaining the regency's excellent highways, which were necessarily neglected during the war, will be resumed normally this autumn. For the requisite repairs a special fund has been set aside by the government in the belief that the want of attention given the roads for the past five years must now be compensated for by extraordinary outlay.

At the same time announcement is made of the creation by a number of Tunisian merchants of a society with a capital of 1,000,000 francs ($193,000) for the establishment of motor truck lines to transport farm crops and other commodities in regions not now well served by the railways. The company is also considering the possible lease to farmers of motor trucks for their own conveyance of crops and other produce to any points or parts in the regency. Considerable point is given to the latter announcement by the fact that the principal railways of the country have just put into effect increases in freight rates varying from 15 to 59 per cent.

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Mudguards for Commercial Vehicles

Wings or mudguards for commercial bodies should be designed not only to keep the bodywork reasonably clean, but also to prevent mud splashing on other vehicles. It is also necessary that the comfort of pedestrians should be considered.

The front wings, which are sometimes supplied with the chassis, should be wide enough to catch most of the mud when the vehicle is under lock, and the radius of action of the stub-axles will usually affect the design of shield between the inner edge of the wing and chassis frame. This should always be fitted, and may be riveted or welded to a metal wing, while the dome-shaped wing can easily be shaped so as to form a wing and side guard in one piece.

Up to the present, few builders design the front wing so that the back end has a fixing on the step, since the majority prefer to carry the wing down to a point about 4 in. below the square line of the center of the wheel, the profile usually curving outward at the bottom, more as a result of following fashion than for any other reason, because a wing which follows the shape of the wheel is necessarily the best mud catcher.

The front end of this wing is often carried along horizontally, but here again if it were made to follow the shape of the wheel a more efficient mudguard would result, especially if the front end were not only curved to the shape of the wheel, but also carried well round, so that the square line of the front of the wheel touched the front edge of the wing. As regards the design of the stays, the front one may have a V or a T shaped flap, either pattern forming a good support for the front end. The rear stay usually runs diagonally across the wing, but if carried straight across the T shaped flap again becomes useful.

Rear wings are often dispensed with, particularly if the body is a wide one, but the relatively small initial outlay is surely worth while, bearing in mind that the underside of the body is kept cleaner, while the general appearance of the truck is improved, owing to the general balance of effect obtained. The mudguard should be shaped to follow the wheel and brought down so that front and back ends are just below the square line of the center of the wheel.

The use of wide bodies mounted on longitudinal and cross bearers of good substance makes the fitting of the rear wing stays a simple problem. Often the flaps of the stays can be bolted on outside the wing with the stays bolted under the main side, or on to the bearers, whichever is the simpler method, and entails the least work in the forging of the ironwork, keeping in view the ideal type of fixing which is one that is as short and as directly supporting as possible.

The width of wings, both front and rear, average about 12 in.; usually greater efficiency will be obtained by increasing this width, so long as the overall width of the vehicle is not unduly increased. The outer edge of the wing should come flush with the square line of the axle cap, while the track of the wheels should also be the center line or longitudinal axis of the wing.

Wood still finds favor as the material used. The fact that the London motor buses are mostly fitted in this way shows that, from an economical point of view at least, there is an advantage over steel. It is a good practice to fasten a small batten on the extreme front and rear ends of the wing, say of 2¼ x ¾ in. stuff, which will prevent splitting, a cheaper process than screwing on a light plate.

A matter which does not always receive proper attention is the question of clearance between the tire and the underside of the wing, which in most cases is the fixing of the flap of the stay. As a rule 6 in. is quoted as the necessary clearance, a measurement which it would seem applies to anything from a two-seater to the heaviest truck. Each job, however, should be decided on the relationship of the adjacent parts. In the ordinary way more clearance is given than necessary. It is very seldom that even a heavy commercial chassis rides up and down more or less vertically to the extent of something less than 6 in. Taking, for instance, an actual chassis which had a clearance of 7 in. given to the front wing, it was found that the chassis could actually come down 6¼ in. if the front springs were cambered about 2 in. in the opposite direction to their normal position. Here 4½ in. would have been ample. In another case 6½ in. clearance was given, yet a special stop was fitted above the front spring fixing so that the chassis was prevented from moving vertically more than 3¾ in. In this case 4½ in. would have been sufficient. Very often one will notice a heavy vehicle, fully loaded, and yet some 5 in. or so clearance still remaining between wing and wheel. If the wings were designed so as to lie closer to the wheel the general appearance would be improved, apart from the fact that they would be more efficient.

Rear wing clearance is of greater importance than that allowed for the front ones, since it affects the general design of the body. If 4½ in. clearance is sufficient for a certain job and, say, 7½ in. has been allowed, it is evident that the whole of the bottom frame has 3 in. more thickness of timber than necessary, which has a decided influence on the cost of construction, while the body is probably 25 to 30 lbs. heavier than it need be, and all goods loaded into the body have to be hoisted every time higher than would be the case had the floor been lower.

Since bodies are often well advanced in construction before the arrival of the chassis, if a wheelhouse is used it has to be designed from the information given on a blue print. Often it is worth while to visit the motor manufacturer's to see an actual chassis. The thickness of any packing piece can be decided, which will, of course, affect the total height of the wheelhouse. At the same time the cross measurement between the rear tires can be taken, a dimension not often given on a blue print, so that the width of the arch can be actually determined.—The Automobile and Carriage Builders' Journal.

At the rate of export indicated in October, the total of passenger automobiles and parts for the full year will total almost $110 000,000, cars alone numbering close to 65,000, worth $70,000,000. The exact October fiugres show 7,898 cars valued at $8,634 965, while the parts amounted to the neat little total of $3,525 079. These figures added to those for the previous nine months give for the year up to October 31, 52,189 cars worth $57,458 726, and parts worth $33,949,092. Canada continues our biggest customer, buying more than one-seventh of the cars. The average price of the 1917 cars was $767; for 1918, $954, and of this year, $1,101.

Shipping shortage during the war compelled agricultural development in Chile, and this forced the resurfacing of the Valparaiso-Vina del Mar road with American paving.

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The New and Unusual in the Automotive Field

Electrically-Driven Grinder Saves Time—Steere Servistock Parts System Economizes Space—Bulldog Tow Chain—Lynite Wheel of Aluminum

It will be the policy of Automotive Manufacturer (as in Automotive Engineering) to present on these pages each month some car, truck, aeroplane, boat, tractor, engine or other unit, which presents unusual and decidedly different engineering features.

Dunham Electrically-Driven Valve Grinder

Facing a set of eight automobile engine valves in from 10 to 15 minutes that ordinarily requires from two to three hours to grind in, an electrically-driven grinder lately placed on the market embodies features of economy that should interest every automobile manufacturer.

Equipped with a 1/12 h.p. high speed Westinghouse motor of standard construction, mounted upon a neat and rigid base, it may be quickly made ready for use by connection to any lamp socket through the medium of the drop cord and plug with which it is furnished. A single snap of the switch sets the motor in motion.

It is made by D. F. Dunham, Los Angeles, Cal. It is always "set up" for service and a ball and socket equipment on the adjusting screw makes it possible conveniently to grind valves whose centers have been mutilated or which have no center.

Simple adjustment features adapt the machine for use with valves of various sizes and shapes. The valve is moved back and forth across the wheel, the valve being rotated by the hand crank in the meantime.

The machine, shown in Fig. 1, was designed primarily for valve facing, but with an extra hub and wheel it can

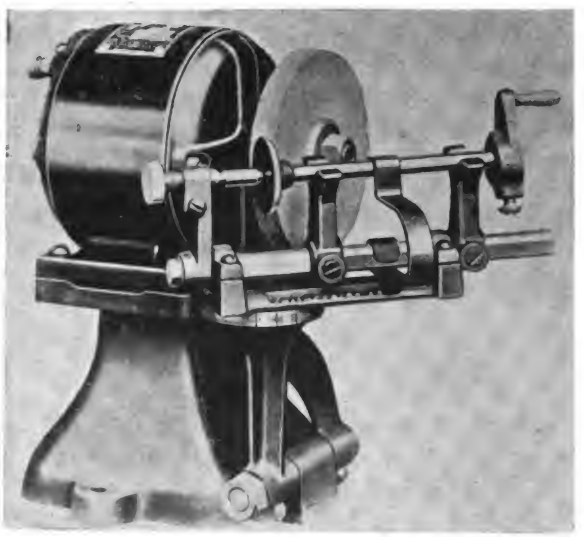

Fig. 1—The Dunham electric valve grinder, with Westinghouse motor

be used for grinding small tools such as drills and chisels. All parts are accurately machined and guaranteed for one year against defects in workmanship and material.

Steere Servistock Parts System

One of the big problems of the manufacturer, at the factory, and in all his branch service stations, is the matter of keeping the stock in a systematic manner. Many and various schemes have been worked out for this purpose, some good, some bad, others indifferent. A new one recently worked out for Ford service stations seems to possess more than the usual merit, as well as many features which permit of its adoption for other service stations with few changes. It is called the Steere Servistock parts system and is designed to save both time and labor, as well as to keep the parts in better condition. It is shown in Fig. 2.

The Steere idea is to have all the parts stored in units numerically arranged following the factory parts list—

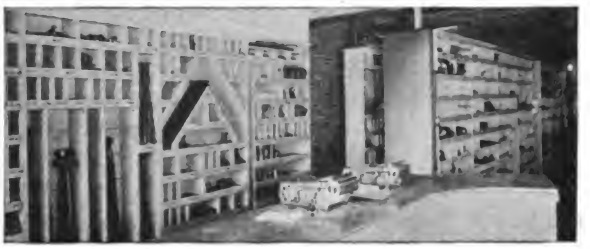

Fig. 2—General appearance of Steere Servistock Parts System Installed

each number having a bin by itself. The bins in turn are built in proportion to the size of the part and quantity of parts required for a month's business.

With the system in use, cheap labor may be employed in the stock room, because a stock clerk need not know the difference between a stud and a bolt, yet if he can read numbers he can fill a stock order.

The units are also arranged to minimize the walking distance in filling an order. For instance, take the filling of a parts order on a rear axle job, which is one of the most common jobs, these parts would come in adjacent units which carry the complete rear axle assembly, and would be located near the shop service window. The units carrying parts for less common jobs are placed correspondingly further away.

When installing the system the number of units is determined by the volume of stock required. Standard systems are 11, 28 and 42 units. They are substantially constructed of a good quality of material; tight joints are a feature. The finish is dado grey, with numbers stenciled in black, unless otherwise specified.

Bulldog Towing Chain

The need for tow chains is now sufficiently well established so that many manufacturers of cars and trucks are placing them in the tool box of the vehicle as part of the standard equipment. Such manufacturers will be interested in the new Bulldog tow chain just put on the market by a well known Cleveland firm. It is an 18 ft. heavy link chain. The following items give a good idea of the excellence of construction:

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First, the links are unusually heavy and strong and the hook at each end is drop forged. What is more exasperating than to start your tow only to have a link give way or one of the hooks straighten out or break clear off?

Second, both ends are covered so that the enamel of neither the car towing or the car being towed is scratched by the links while coupling or uncoupling.

Third, each chain is packed in an individual bag, making it easy to handle and keeping any mud picked up off the other tools of your tool box.

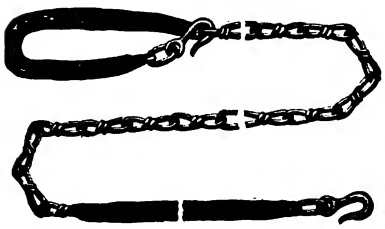

Fig. 3—Bulldog tow chain with forged end links

The average motor car owner who has never needed a tow does not fully appreciate what embarrassment can follow the breakdown of his engine while many miles from home. Most passersby will gladly give a helping hand, but can he expect them to carry tow lines if he carries none himself?

The Bulldog tow chain is made of 10/0 bulldog chain, 5/16 in. material with a tensile strength of 4,400 lbs., and has a hot-galvanized finish. It is 18 ft. in length with drop forged hook on each end and the links on each end are covered to protect the enamel of both cars.

Lynite Aluminum Wheels

Metal wheels, either of the spoked or disc type, possess many advantages over wood wheels and a few over the wire type, but the new Lynite wheel of aluminum should have all these advantages over wood and wire plus a tremendous saving in unsprung weight. It is claimed that the physical properties of this new wheel will cut the wheel weight to one-half, that is, save half of the total wheel weight. These wheels are made for both cars and trucks, and extensive tests have shown they will stand up as well as other wheels. The advantages of lessened unsprung weight are easier riding qualities, saving in tires and fuel, reduced repairs, and on trucks increased pay loading.

The aluminum wheel has been developed experimentally by the Aluminum Castings Co. It is a one-piece aluminum alloy casting made of the new Lynite No. 145. This alloy was recently developed by the Lynite laboratories after years of research, and with a specific gravity of only 2.9, a tensile strength of 27,500 lbs. per sq. in. and an elongation in two inches of 4.5 per cent, it is considered the strongest aluminum casting alloy yet produced.

Less attention is probably given by the engineer to the wheels of the motor car or truck than to any other part. The importance of reducing the weight of the motor vehicle below the springs is generally appreciated and designs reveal the fact that this requirement is being carefully studied. It is obvious that when the motor vehicle is traveling over an irregular road there is a tendency for one or both wheels to break contact with the ground immediately upon striking some obstacle. If the rear wheel leaves the ground it is free to rotate at any speed which the engine may induce, i. e., at any abnormal rate of speed. Consequently, when the wheel again comes in contact with the ground a certain amount of "slip" must occur until its speed conforms with that of the other wheel. As this slip is very detrimental to the tire, causing severe road friction and tire grinding, it is quite desirable to pay every attention to available methods for avoiding such fault.

At first thought it might appear that cars with a large unsprung weight, as illustrated in so-called carry-all types with heavy axles and heavy wheels, there should be a more secure hold on the road than when these parts are of lighter weight. But further consideration will show this thought to be an error. Consider any motor vehicle of any standard spring suspension with a full load. Remove the regular wheels and replace them with typical cast iron railroad wheels. Drive this car at a rapid rate of speed, strike a rock projecting above the road surface and what happens? The wheel will be thrown upward causing a compression of the springs which will only partially absorb the shock, the remainder of which will be transmitted to the body of the car. Now replace these wheels with a set made of paper mache. Drive this car at the same rate of speed, strike the same rock and what happens? Supposing the paper mache wheel can stand the shock, it will be thrown upward as before causing a compression of the springs which will again absorb the shock. This time, however, the shock transmitted to the body will be very slight for the body is so much heavier than the wheel that the springs will drive the wheel downward rather than drive the body up.

Sets of Lynite wheels are now on test on five or six different standard trucks and to date have shown up very favorably. One set of solid tire wheels installed over four years ago have averaged 30 miles per day over severe roads and only one set of tires has been replaced.

Lynite wheels are designed in either the spoke or disc type. Their beauty of appearance highly recommends

Fig. 4—New Lynite aluminum wheel of the spoked type—Disc type appears similar to steel disc wheel except for white color

them. Their lightness facilitates wheel change in the garage or on the road. Moreover, it is a simple operation to remove the tire from a Lynite wheel for aluminum does not rust and the tire does not stick or "freeze" to the rim as in the case when the rubber bears against a steel rim.

Furthermore, Lynite conducts heat four times as well as iron or steel and, therefore, the tire is kept cooler in long distance operation.

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New and Improved Ideas in Body Finishing

New Quantity Methods Not for Small Shops

Present day painters and finishers occupying the smaller shops, have been told in magazine articles and elsewhere, with a laborious completeness of detail, of the new and finer ways of painting and finishing, until, bewildered, they have begun to question the value of the time-honored way when measured in comparison with these newer systems.

What the promoters of these new ways of finishing have neglected to do consists of notification to the public that, as a rule, they are confined to the needs and requirements of factory and city jobbing shops.

In the smaller shops, to which this magazine comes as a regular visitor, with, in many cases, restricted quarters and few conveniences, the newer ways are unsuited, or at any rate, unavilable. Apparatus for water-washing the air before it comes into the room, the atomizer to spray on the color coats, and finally the baking over to master the drying of the varnish coats are now in order. These are helps to not alone hurry the drying of the individual coats, but to make them cleaner and deepen the lustre.

However, we would advise our readers who are not permitted to enjoy these conveniences not to despair. The natural air-dried finish, and the application of this finish, remains an excellent way both in point of durability and appearance. The old way need not suffer in comparison to the new to such an extent as to be no longer available. The matchless surfaces which for many years have characterized the results of this same old way, the great durability of the finish, together with all the fine details worked out to their fullest extent, represent a measure of success yet to be attained by the practice of the so-called "new system." In hundreds of small paintshops throughout the country there are carriage painters of the highest skill; and these men with only the cruder methods and conveniences at their disposal, are accomplishing results for which no apologies need be offered. They are employing the most beautiful colors, and the manner of using the varnish over such colors is of the most approved type. With shops not of the cleanest because human ingenuity is unequal to the task of making them only fairly clean, except through tearing down and building new, or remodeling at a prohibitive expense, these men of faith, and larger vision, and steadfast purpose, are doing things which to many city painters in like circumstances would seem impossible.

The finish turned out of these shops may not appear so faultlessly clean, and may possibly fall short a trifle in lustre, but generally speaking it wears to the end, looking brave and fine all the time.

Plywood specimens glued with animal, vegetable, casein, and blood albumin glues and soaked for 20 weeks in gasoline, engine oil and castor oil at the Forest Products Laboratory, showed no separation of the plies. Shear tests, however, gave evidences that a gradual weakening of the glue was going on. The loss in strength in no case was as much as would be caused by the standard test of soaking for ten days in water.

The man who lets a little authority puff him up like a balloon is simply enlarging his chances of getting punctured.

Current Automotive Metal and Supply Prices

General Business

All manufacturers and all manufacturing carry a hopeful tone relative to the future, and particularly the near future. The holiday retail trade was the best ever known; the automobile industry is ending the year with the unusual combination of the biggest year's business and the biggest existing demand ever. Exchange has reacted from the low point, imports are increasing more than exports, although the latter hold up very close to record proportions. The passage of the Edge bill, supposed to assist exporting through making the financing easier, has had no results to date.

Iron and Steel

While the coal strike has been settled, the miners have returned to work, and all fuel restrictions have been lifted, it is too early after the cessation of work for capacity output. The demand keeps up, however, and unfilled tonnages are greater than ever. More recently, the apparent shortage for the first quarter of 1920, coupled with large buying on the part of automobile interests with doubled plans for 1920, have boosted a number of price quotations. Iron has moved up further than steel, No. 2X Phila. being up $5, and No. 2 Valley furnace up $6 a ton.

Copper and Aluminum

Early in December copper receded to 18c, at which level considerable quiet buying was evident. Japan is a big buyer and buys heavily whenever the price dips down. Germany is in the market, too, for large tonnages, one inquiry for 60,000 tons being reported, but the difficulty there is the financial arrangement. The end of the month saw a good steady demand with prices rising slightly, and approximating 20c. Little activity is expected until the turn of the year, but estimates of the business in December vary from 250,000,000 to 350,000,000 lbs. Virgin aluminum in ingots is steady at $32 to $33. There is no change in this, and little or no activity.

Lead and Antimony

Lead has been moving steadily upward, the leading producer increasing the price from 7.15c to 7.50c New York no later than December 26. The outside price is very strong, and this quotation undoubtedly will be revised upward again in January. The outside market quotations approximate 8c. There seems to be a real scarcity of the metal. Antimony is quiet and wholesale lots for early delivery are quoted at 9.62½c duty paid, New York.

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Tin and Zinc The value of the English pound seems to be the barometer in the tin market, the price receding as the exchange rate declines. Some business has been done each day despite the declining price. This went from 54 to 53½ around the middle of the month when sterling took the big drop, but subsequently reacted. Zinc, too, is closely dependent on sterling exchange. It followed down from 8.75 to 8.50, New York, then reacted. During all this period of changing prices there was a strong market undertone and considerable buying each day.

Other Metals Domestic ferromanganese is scarce because of shortage of shipping facilities, and has recently been marked up $10 a ton, while English quotations are nominal for the same reason. Chrome and spiegel are up, but Scheelite and wolframite continue low.

Old Metals Buying is of the hand-to-mouth variety. Steel scrap seems to be a little higher. Malleable is in demand and has advanced. All forms of copper and lead scrap have moved up with the pure metals.

Chemicals Demand for heavy chemicals continues strong. Sodium bicarbonate is in tremendous demand and priced accordingly. Caustic soda is up, as is benzol, denatured alcohol and white salammoniac.

Fabrics Hemp and cotton yarns are up. Burlap is quiet, but importers are talking of higher prices in 1920 effective almost immediately. Cotton wastes are stationary. Tire fabrics are steady.

Other Materials There is a lively market for automobile leathers, and manufacturers are having difficulty in keeping up with the demand. A larger proportion of closed cars is relieving the leather situation somewhat. Machine buffed is quoted (December 12) at 55c, hand buffed at 65c, and special machine buffed at 45c. All petroleum products are up.

The prevailing prices compared with last month's are as follows. Every effort is made to have these as accurate as possible, but none are guaranteed. Many are obtained through trade sources dealing in large quantities, so these may not be realized on smaller quantities:

	Nov. 8	Dec. 12
Acid, Muriatic, 20° (Hydrochl).lb.	$0.02 — .02½	$0.02 — .02½
Acid, Sulphuric, 66°.....ton	20.00 —21.00	20.00 —23.00
Alcohol, Wood, 97 p.c.....gal.	1.33 — 1.38	1.33 — 1.38
Alcohol, Denatured .....gal.	.58 — .60	.64 — .66
Aluminum, Metallic, in Ingots		
No. 1 99% pure, carload lots.lb.	.33‖	.33 — *.35
Ammonium Chloride (Sal-Ammoniac) white, lump.....lb.	.13½— .14	.13½— .14
Antimony, Asiatic .....lb.	.09¼— .09¾‖	.10 — *.10½
Babbitt Metal, best grade.....lb.		.90*
Babbitt Metal, Commercial....lb.		.50*
Beeswax, natural crude, yellow.lb.	.42 — .44	.42 — .44
Carnauba No. 1 Wax.....lb.	.85 — .88	.85 — .87
Copper, Lake, ingot.....lb.	.20‖	.20 — *.21
Copper, Electrolytic .....lb.	.19¼— .19½‖	.19½— *.20
Copper, Casting .....lb.	.19‖	.19 — *.19½
Lead, Pig .....lb.	.06¾‖	.07⅜— *.08¼
Lead, Bar .....lb.		.08¼— *.08¾
Lead, Red, dry.....lb.	.13	.13
Paraffin, ref. 120.....lb.	.07 — .08	.06½
Potash, Caustic (85-92 p. c.)..lb.	.35 — .40	.35 — .40
Pumice, Ground (domestic)....lb.	.02½	.02½
Shellac, TN .....lb.	1.00	1.10 — 1.15
Orange, superfine .....lb.	1.10 — 1.30	1.25
Bleached, bone dry.....lb.	1.20	1.35
Sodium Hydrate (Caustic Soda) 76 p. c.....100 lb.	3.45 — 3.50	3.80
Solder, half and half.....lb.		.37*
Solder, No. 1.....lb.		.33*
Solder, Refined .....lb.		.28*
Tin, Metallic straits pig.....lb.	.53½‖	.55½— *.56½
Turpentine, spirits of crude.....	1.58	1.65 — 1.66
Zinc, Western Spelter.....lb.	.08‖	.09¼— *.09½
No. 9 base casks, open.....lb.		.13*

‖ Nov. 22. *Dec. 16.

OLD METALS

Dealers' purchasing prices paid in New York are as follows:

	Nov. 18	Dec. 16
Copper, heavy and wire.....	14.50—16.00	15.50
Copper, light and bottoms.....	13.00—14.00	13.50
Brass, heavy	8.50— 9.50	10.00
Brass, light	6.50— 8.00	7.00
Heavy machine composition.....	.....	15.50
No. 1 yellow brass turnings.....	8.75— 9.25	9.00
No. 1 red brass or composition turnings....	12.50—14.00	12.00
Lead, heavy	5.38— 5.88	6.00
Zinc	4.38— 5.25	5.00
Heavy steel scrap, Pittsburgh.....	23.00	25.00
Heavy steel scrap, Philadelphia.....	20.50	22.50
Heavy steel scrap, Chicago.....	18.00	20.50
No. 1 cast, Pittsburgh.....	28.00	30.00
No. 1 cast, Philadelphia.....	29.00	31.00
No. 1 cast, Chicago (net ton).....	28.50	32.50

PIG IRON

Per Gross Ton:	Nov. 18	Dec. 16
No. 2 X, Philadelphia§.....	$36.00	$41.10
No. 2, Valley furnace†.....	32.00	38.00
No. 2, furnace, Chicago*.....	32.00	40.00
Basic, delivered, eastern Pennsylvania.....	31.25	35.00
Basic, Valley furnace.....	30.00	35.00
Bessemer, Pittsburgh	32.90	37.40
Malleable Bessemer, Chicago*.....	32.50	40.50
Malleable, Valley	32.00	37.00
L. S. charcoal, Chicago.....	37.50	42.50

*Average switching charge in the Chicago district is 50c per ton. †Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.

IRON AND SOFT STEEL BARS

Bars.	Nov. 18	Dec. 16
Merchant iron, base price.....	....	3.35—4.00c
Refined iron, base price.....	3.27c	3.35—4.00c
Soft Steel:		
¾ to 1⅞ in., round and square.....	3.52c	3.52—3.62c
1 to 6 in. x ⅜ to 1 in.....	3.52c	3.52—3.62c
1 to 6 in. x ¼ and 5/16.....	3.62c	3.62—3.72c
Rods—⅝ and 11/16.....	3.42c	3.42—3.67c
Bands—1½ to 6 x 3/16 to No. 8.....	4.22c	4.22—4.32c

BOLTS AND NUTS

	Nov. 18 % off list	Dec. 16 % off list
Machine bolts h.p. nuts, ½ x 4 in.: Smaller and shorter, rolled threads	50	50
Cut threads	50-10	50-10
Larger and longer sizes.....	50	50
Machine bolts, c.p.c. and t. nuts, ½ x 4 in.:	40-5	40-5
Smaller and shorter.....	40-5	40-5
Larger and longer.....	35-5	35-5
Carriage bolts, ½ x 6 in.:		
Smaller and shorter, rolled threads	45-5	45-5
Cut threads	40-5	40-5
Larger and longer sizes.....	30-10	30-10
	per lb. off list	per lb. off list
Hot pressed nuts, sq. blank.....	2.50c	2.50c
Hex., blank	2.50c	2.50c
Sq., tapped	2.25c	2.25c
Hex., tapped	2.25c	2.25c
C.p.c. and t. sq. and hex. nuts, blank	2.50c	2.50c
C.p.c. and t. sq. and hex. nuts, tapped	2.25c	2.25c
Semi-finished hex. nuts:	% off list	% off list
⅝ in. and larger.....	65	65
9/16 in. and smaller.....	70-10	70-10
Tire bolts	60-10	60-10

The above discounts are from November 1, 1919.

BRASS AND COPPER SHEETS AND SHAPES

	Nov. 10	Dec. 12
Copper sheets, hot rolled.....lb.	.33½	.28½
Copper sheets, cold rolled.....lb.	.35	.37
Copper rods .....lb.	.24¾	.25¾
Copper wire .....lb.	.26	.21½
High brass wire and sheets....lb.	.27¾	.24¼
High brass rods.....lb.	.26¾	.27
Low brass wire and sheets....lb.	.30½	.26¼
Low brass rods.....lb.	.31¼	.27
Brazed brass tubing.....lb.	.39	.30½
Brazed bronze tubing.....lb.	.44¼	.40¾
Seamless copper tubing.....lb.	.37½	.32
Seamless bronze tubing.....lb.	.44¼	.34½
Seamless brass tubing.....lb.	.36	.30½

FERROALLOYS

	Nov. 20	Dec. 12
Ferromanganese, 80% delivered producers' price	$110.00	$120.00
Spiegel, 18% to 22% furnace, spot	33.00 to 35.00	33.00 to 36.00
Ferrosilicon, 50%, spot and contract, delivered	80.00 to 85.00	85.00 to 95.00
Ferrotungsten, standard, per lb. contained, furnace	1.10 to 1.20	1.25 to 1.40
Ferrochrome, 60% to 70% chromium, 6% to 8% carbon, per lb. contained, maker's plant..	27 to 29 cents	25 to 40 cents
Ferrovanadium, 35% to 40% per lb. contained, according to analysis	$5.50 to $7.00	$5.50 to $7.00

Ferrosilicon prices at Ashland, Ky., Jackson and New Straitsville, O.

CRUDE RUBBER

	Nov. 15	Dec. 12
Para, Upriver fine.....lb.	$0.52 —$0.52½	$0.53 —$0.54
Upriver coarse .....lb.	.35 —	.... — .35½
Upriver caucho ball.....lb.	.35 — .35½	.34½— .35½
Plantation, first latex crepe...lb.	.53 — .54	.51½— ....
Ribbed smoked sheets.....lb.	.52 — .53	.51½— ....
Brown crepe, thin, clean....lb.	.45½—	.46½— .47½
Amber crepe No. 1.....lb.	.48½—	.49 — ....

PETROLEUM PRODUCTS

	Nov. 24	Dec. 27
Oil—Pennsylvania Crude	$4.50	$4.75
Kansas and Oklahoma Crude.....	2.50	2.75
Healdton, Crude	1.35	2.00
Fuel, 28-31 deg.....	.14	.14
Gasoline, Motor, garages, steel bbls.....	.24½	.24½
Consumers, steel bbls.....	.26½	.26½
Lubricating Oil, black, 29 gravity.....	.20—.22	.20—.22
Cyl. light filtered.....	.45—.50	.48—.55
Dark filtered	.42—.48	.45—.50
Extra cold test.....	.55—.60	.60—.65

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London-Paris Air Mail Saves 16 Hours

Final official arrangements have been made by the British postmaster general for air mail service between London and Paris, in fact the service was started on Tuesday, November 11. The service extends to Paris and France generally, Italy, Spain, Switzerland, etc. Registered and unregistered letters, post cards, packets of printed papers and commercial papers, and samples are accepted for transmission. Parcels and insured correspondence are not accepted. A special fee at the rate of 2s. 6d. per ounce is charged in addition to the ordinary foreign postage and registration fee, where payable. Correspondonce for transmission by the air mail service is accepted daily, except Sundays, at the London post offices.

Arrangements have been made at certain provincial post offices for the acceptance of correspondonce intended for transmission by the air mail service. Such correspondence is forwarded as express letters to London, and is despatched by aeroplane on the following morning. The correspondence is conveyed to Paris by aeroplane, arriving in normal conditions in time for delivery in Paris in business hours the same day. Correspondence addressed to Paris is thus accelerated by about 16 hours. Correspondence for places beyond Paris is forwarded by the next available train. Correspondence for places in France is delivered by express on arrival at the offices of destination. Correspondence for countries beyond France is normally accelerated by 24 hours.

In the inward direction, correspondence posted in Paris in the morning normally reaches London in time for delivery in Central London (i. e., E.C., W.C., E.1, N.1, N.W.1, W.1, W.2, S.W.1, and S.E.1) during business hours on the same day. It is delivered immediately on arrival by express messenger without additional charge. Correspondence for provicinial towns is forwarded by the next despatch from London, and usually gains 24 hours in delivery. If it is known in advance that flight will be impossible on any particular day a notice to that effect is exhibited at the offices mentioned above. Responsibility for registered correspondence is admitted under the usual conditions, otherwise correspondence is accepted at sender's risk.

How to Accomplish Rapid Kiln Drying

Every wood using industry is interested in finding a quick method of seasoning wood and expects that some day a new type of kiln will be devised which will accomplish more rapid drying. The U. S. Forest Products Laboratory has observed, however, that few kiln operators attain the fastest safe rate of drying possible with present known equipment, and that quick satisfactory drying depends more on the kiln operator than on the kiln itself.

These are things that when they apply make for slow drying in any kiln:

1. Some one part of the kiln load is drying slowly because of sluggish and uneven circulation, and is holding up the entire kiln run.

2. The kiln operator does not know when the lumber reaches the desired moisture content, and therefore leaves it in the kiln longer than necessary.

3. The lumber may be casehardened and therefore unable to stand fast drying.

4. Lumber air seasoned six months is given exactly the same treatment as that air seasoned only four months.

5. The kiln operator does not know the moisture content of the lumber when it is put in the kiln, and therefore can not apply the initial drying conditions which are conducive to most rapid drying.

6. The drying schedule is regulated by the number of days the lumber has been in the kiln rather than by the actual moisture content of the stock and its ability to withstand more severe drying conditions.

7. Steam is not supplied to the heating coils at night.

8. The kiln operator looks at his kiln only once a day, and then does not look at the lumber itself.

It is within the limit of commercial possibility for 1 in. lumber to be perfectly kiln dried from 18 per cent moisture content (reached, perhaps, in three months yard seasoning) to 5 per cent moisture content, and conditioned for use, according to the following schedules:

	Days
Red gum	6- 8
Hard maple and birch	5- 7
Plain-sawed oak	8-10
Walnut and mahogany	6- 8

Western Farmers Buying Many Tractors

That western farmers are buying tractors for farm use very freely is apparent in figures from Iowa. Discussing them recently, I. Whitted, publicity man for the Iowa federation of farm bureaus, said that a count made at the beginning of the present year showed 9,100 tractors owned by farmers in that state. This represented an increase during the year 1918 of more than 4,700. To what extent the number has been increased this year is unknown, as no census has been taken since the first of the year.

"Six years ago," Mr. Whitted continued, "there were not more than 1,000 tractors in the entire state. That was an average of about one tractor to every 200 farms. On January 1 of the present year there were by actual count 9,100 tractors on the farms ready to start the spring work, an average of one tractor to every 22 farms.

"The Iowa farmer turned to the tractor because it helps toward the solution of the vexatious problem of farm labor. Forty years ago there were no large cities west of the Mississippi River. At that time perhaps four-fifths of the population of Iowa lived on farms or in small towns and looked to the farm for work.

"When the war broke out Iowa had no labor to spare. Iowa furnished 100,000 men for the army and navy, and no man knows how many more thousands left the farms, stores, trades and industries to take up other lines of war work. The farmer was up against the most acute labor shortage this country has ever known. And in the face of such conditions he was asked to produce two bushels where only one was produced before.

"It sounded like an impossible order. But is was filled. In the space of a few months the farmer had purchased more tractors than he had in the ten years previous.

"Statistics show that on January 1, 1918, there were 4,363 tractors on the farms of the state. Count on January 1. 1919, showed 9,100, more than 100 per cent increase."

In October, oil shipments from Mexico established a new record with a total of 8,297,938 bbls. of 42 gals. each, as compared with 7,131,417 bbls. in September. The total to the United States and possessions was 5,796,933 bbls., which is at the rate of 70,000,000 bbls. a year. The big increase came from Port Lobos, Tampico and Tuxpam just barely exceeding last month's totals.

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Men of the Automotive Industry

Who They Are What They Are What They Are Doing

William M. Corse has resigned as technical superintendent of the Ohio Brass Co., Mansfield, O., to become general manager of the Monel Metal Products Corp., Bayonne, N. J. The Monel company, which specializes in monel metal and aluminum bronze castings, formerly was the Bayonne Casting Co. Prior to his connection with the Ohio Brass Co., Mr. Corse was associated with the Titanium Bronze Co., Niagara Falls, N. Y., and the Detroit Lubricator Co., Detroit. In 1908 he was elected secretary-treasurer of the American Institute of Metals, now the Institute of Metals division of the American Institute of Mining Engineers, and became president of that society in 1917.

Robert C. Henes, until recently assistant superintendent of the pressed and sheet metal department at Dodge Bros., Detroit, Mich., has been made superintendent of the corresponding department in the Willys Corp. M. W. H. Wilson, formerly assistant to the general works manager of the Cadillac Motor Car Co., Detroit, has been made superintendent of maintenance and equipment at the Elizabeth plant. During the war Wilson served as works manager of the Wright-Martin Aircraft Corp. plant at Long Island City and is credited also with laying out the new Cadillac plant that is now in course of construction.

Fred J. Fisher has been elected president of the newly organized Fisher Body Co., Cleveland, O. Other officers are: Charles T. Fisher, vice-president; L. Mendelssohn, treasurer, and A. Mendelssohn, secretary. The officers held the same positions with the Fisher Body Corp., and were all incorporators of the Titan Motors Co. John Sherwin and Charles A. Otis, directors of the Chandler Motor Co.; E. F. Fisher, A. J. Fisher, L. Fisher, Sr., Grovener Hutchins, J. R. Kraus, Frank H. Ginn, Richard Inglis, C. V. Crowther, Norris J. Clarke and the officers were elected directors of the company.

Robert A. Weinhardt, an engineer, has been added to the staff of the Supreme Motors Co., Warren, O. Weinhardt began his engineering career in 1906 when he became designing engineer of the Nevada Motor Car Co., of Chicago. Later he became connected with the Multi-Motor Gas Engine Co. He designed the original motor for the Falls Motor Co., and served with Sommer & Rossom Co., and then with the Henry Motors Co., following which he went to the Continental Motors Co. It is the latter company Weinhardt is leaving to throw his lot with the Supreme Motors.

R. P. Henderson has been made vice-president and director of sales of the Martin-Parry Corp., with headquarters at Indianapolis. Henderson has been general sales manager of the Parry Mfg. Co. for the past three years, and prior to that was associated with the Cole Motor Car Co. However, before he became connected with the Cole company, he had acted as sales manager for the Parry Mfg. Co., and back in 1912 was vice-president and general manager of the Henderson Motor Car Co.

Otis C. Friend has organized the Friend Motors Co., Pontiac, Mich., with a capital of $2,000,000, and becomes its first president. The new concern has purchased all the assets of the defunct Olympian Motors Co. of that city and plans an output of 3,500 cars in 1920. Mr. Friend retired as secretary and sales manager of the Mitchell Motors Co. about four years ago to become an executive of the United Motors Corp., which he left to assume the position of vice-president of the General Motors Co.

H. D. Wilson has been appointed vice-president of the Herschell-Spillman Motor Co., North Tonawanda, N. Y. Wilson is well known to the industry through his connection in executive and administrative capacities with many leading manufacturers, including the Packard Motor Car Co. and Eisemann Magneto Co., of Stuttgart, Germany. His last connection was with the Bijur Motor Appliance Co., Hoboken, N. J., from which he resigned as sales manager to join the Herschell-Spillman organization.

G. L. Guyman has joined the Mercer Motors Co., Trenton, N. J., as assistant general manager. Guyman has been with the Packard Motor Car Co. since 1908, and was appointed assistant truck sales manager in 1915. In this capacity he handled the company's large truck orders from the Allies until the entry of the United States into the war. At that time the Packard company gave Guyman entire charge of the operations at the immense truck factory working on government orders.

Milton J. Ludlong, widely known in the automobile industry through his successive executive connections with the Electric Vehicle Co., N. A. A. M., Packard Motor Car Co., and most recently with Gaston Williams and Wigmore, Inc., as vice-president and general manager, has been appointed distributor for New York and the metropolitan district of the new Lincoln car. This marks his return to the retail trade after an absence of many years.

Charles D. Hastings, former vice-president and general manager Hupp Motor Car Corp., Detroit, has been elected president to succeed J. Walter Drake who will continue as chairman of the board of directors. Mr. Hastings has been connected with this company in an official capacity ever since it was started, he and Robert C. H. Hupp forming the original company, which began operations with the backing of a Michigan Congressman.

Lorne A. Scott, well known to the eastern trade as a builder of automobile structures, among other activities, is entering the motor truck producing field. He has secured a factory at Garwood, N. J., formerly occupied by the C. & C. Electrical Co. The line of trucks that will be produced embraces 1½, 3 and 5 ton capacities, which have been designed for Scott by Arthur J. Slade, late lieutenant-colonel Motor Transport Corps, A. E. F.

Charles Baasch, for many years connected with the Springfield Body Co. and more recently manager of the New York office of the Blue Ribbon Body Co., Bridgeport, Conn., has established himself at 1823 Broadway, New York, as automobile body engineer and designer. Baasch will not build bodies himself but will supervise the execution of his designs at other body-building establishments.

Don T. Hastings and **R. H. Williams** will take over the sale of Hupmobile cars in Detroit and vicinity, January 1 when the contract of the present agency expires. Hastings is the son of President Hastings, a technical graduate, was previously assistant chief engineer of the company and more recently has been connected with Rax Wadman, technical advertising, in charge of the Chicago office.

George L. McCain, research engineer for the Packard Motor Car Co., and during the war assigned to the airplane engineering department, engine design section of the U. S. Signal Corps at Dayton, O., has been appointed car chassis engineer of the Packard organization. McCain fills the place left vacant by the promotion of E. G. Gunn to chief engineer of the carriage department.

Robert E. Naylon, formerly superintendent of the gear department of the Hudson Motor Car Co., has been appointed to a similar post in the Willys Corp. A. R. Kelso, formerly chief tool designer for Hudson, has been placed at the head of Willys' tool design department. A. D. Kinsey, formerly works manager of the Racine Mfg. Co., is in charge of sheet metal work and stampings.

O. E. Szekely has resigned as engineer and production manager of the tractor department of the Velie Motors Corp., Moline, Ill., and has organized the O. E. Szekely Co., with offices at 202 Safety Building, Rock Island, Ill. He is president and chief engineer of the organization, which specializes in designing and consulting mechanical and automotive engineering work.

Lieut.-Col. Mitchell Mackie, formerly chief maintenance engineer of the Motor Transport Corps, has returned to his post as sales engineer of the Waukesha (Wis.) Motor Co. Mackie has returned with valuable experience gained as a result of his stay in France, where he had an opportunity of looking over the German trucks after the signing of the armistice.

Walter Y. Anthony, for many years a prominent executive of the Packard Motor Car Co., of Philadelphia, and assistant general manager since 1916, has been promoted to the office of general manager to succeed Lee J. Eastman, recently elected president and general manager of the Packard Co., in New York. Mr. Anthony joined the Packard forces in 1909.

J. A. Tarkington, superintendent and consulting engineer of the Kissel Motor Car Co., Hartford, Wis., will leave the company on January 1 to become directing head of the Tarkington Motor Car Co., organized at Rockford, Ill., to manufacture passenger automobiles. Mr. Tarkington has been connected with the Kissel company for nearly 14 years.

W. E. Seymour, Beloit, Wis., has been elected vice-president and general manager of the A. O. Smith Corp., Milwaukee, which is spending $3,500,000 in plant extensions and equipment. Mr. Seymour comes from the Eclipse works of Fairbanks, Morse & Co., Beloit, where for six years he was general superintendent. W. C. Heath takes his place.

John Cetrule, who was formerly stationed at the plant of the Wright-Martin Aircraft Corp., Long Island City, N. Y., as an inspector in the aviation section of the Signal Corps, has been transferred to Camp Nyssa, Farmingdale, N. Y., where he is serving in the motor transport division of the Reserve Officers' Training Corps.

W. L. Perley, late lieutenant in the Bureau of Aircraft Production, has been made assistant to President C. S. Rieman, of the Elgin Motor Car Corp., Argo, Ill. Perley was for two years assistant to the director of engine production in this bureau, and closed his war service by writing a voluminous history of this phase.

F. R. Conroy has been appointed superintendent of the Wisconsin Parts Co., filling the place left open by the resignation of J. L. Armstrong which took effect November 22. Conroy formerly was with the Cadillac Tool Co. and has also been associated with the Ingersoll-Rand Co., Willys-Overland, Inc., and the Garford Co.

H. G. Weaver has been placed in charge of the sales promotion department recently established by the Hyatt Roller Bearing Co. at Chicago, Ill. For the past year he has spent his entire time in the field with farmers and dealers in power farming machinery making an investigation of the conditions which exist.

Albert H. Mitchell has become associated with H. W. Cottin, Inc., of Brooklyn, N. Y., as vice-president and general sales manager, with headquarters at their New York office in the Woolworth Building. Mr. Mitchell was formerly with Taft Pierce Mfg. Co., of Woonsocket, R. I., for the past nine years.

E. T. Musson, formerly general manager Canadian Aeroplanes Co., has been made vice-president in charge of production of the Buffalo Body Corp. Prior to his association with the Canadian Aeroplanes Co., Musson was superintendent of the Russell Motor Car Co., West Toronto, Can.

J. W. Hobbs, who was in command of an ordnance repair shop with the A. E. F. in France, has been discharged from the Army with the rank of captain and has been placed in charge of the truck and tractor experimental laboratory at the Rock Island Arsenal, Rock Island, Ill.

James Guthrie, consulting motor vehicle engineer, Cleveland, has received his commission as lieutenant colonel in the Reserve Corps, U. S. A. Guthrie was a major of reserves before the war, and served with the Ordnance Corps as engineering representative in Michigan with that rank.

Paul M. Lincoln, for many years commercial engineer of the Westinghouse Co., Pittsburgh, has resigned from that organization, effective November 1, to enter the consulting engineering field, and have active charge of motor application for the Lincoln Electric Co., Cleveland.

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Activities of Automotive Manufacturers

Where They Are Located What They Are Doing How They Are Prospering

Rex Motor Car Mfg. Co. is erecting a plant in New Orleans for the purpose of manufacturing the Rex car. The plans call for a car built of standard parts with the exception of the Rex-Sinclair six-cylinder engine to be manufactured by the Sinclair Motor Co., and which has had the approval of the professors of engineering of Tulane University. The officers of the company are: Robert Booth, president and general manager; E. C. Upton, H. C. Maynard, A. C. Sinclair, and John Studebaker Lucas. Booth is the inventor of the Booth sectional export body and a car designer. The company anticipates being in production by February.

Nash Motor Co. has completed the first unit of its new plant at South Milwaukee, consisting of a structure 200 x 600. It was completed in 75 days and equally rapid work is expected on the power house, 75 x 150, which is now under way. This Milwaukee plant will be devoted to the new Nash Four, while the Kenosha plant will turn out the Six and the tractor. The 5,000 employes at the Kenosha works will be duplicated at Milwaukee when that gets under way early in the new year.

Vreeland Motor Co., Inc., 407 Elizabeth avenue, Newark, N. J., manufacturer of motor trucks, is planning for a new plant in the Irvington section. Property aggregating about eight acres has been acquired and construction will be inaugurated in the early spring. The additional capacity will be about 400 trucks per year. E. E. Vreeland, formerly president and general manager of the Abbot-Downing Truck & Body Co., is president. S. D. Weaver is vice-president and general manager.

Napoleon Motors Co., Traverse City, Mich., is completing plans for a considerable expansion of its business, with an increase in its factory space through the construction of additional buildings to replace some buildings which were burned. The company will cease the manufacture of passenger cars in the future, and is now cleaning up the last of this class of cars to devote its entire attention to the Napoleon truck. This is manufactured in two models—1 ton and ½ ton capacity.

American-La France Fire Engine Co., Inc., Elmira, N. Y., has purchased a 23-acre plot near Newark, N. J., on which it will build a plant to manufacture a truck. The company is planning to build the motor and the parts, and it is emphasized by J. R. Clarke, president nd general manager, that the truck will not be an assembled product. At the present time the company is contemplating making two sizes, 5 and 3½ ton.

New York Air Brake Co., New York and Watertown, N. Y., is about to enter the vehicle manufacturing field with trucks and tractors, and possibly passenger cars. These will have a number of special features, including the Deppe vaporizing device, which will handle any kind of heavy fuel, both at starting and while running. Other details of the proposed vehicles are refused by the company officials.

Winther Motor Truck Co., Kenosha, Wis., is entering into production on a new product, the Winther Six passenger car. This is said to have an unusually efficient power plant, unique body and other features. Deliveries will start about January 1. Trucks will be continued; in fact, the schedule for 1920 shows an increased output of trucks.

H. H. Franklin Co., a new organization, allied with the Franklin Automobile Co., is to bubild a one-ton truck. Present plans call for production in a separate and distinct plant within about 12 months. The new truck will be a pneumatic-tired vehicle, designed particularly for use on farms and in general country utility work.

Reliance Motor Truck Co., Appleton, Wis., has deferred until early spring the erection of a four-story addition, 70 x 300 ft., for manufacturing rear axles and increasing its capacity for building motor trucks. The estimated investment will be $250,000. John M. Balliet is president and general manager.

Militor Motors Corp., New York and Springfield, Mass., has completed its purchase of the plant of the Knox Motor Co. in the latter city. The Knox company reserves the right to use part of the buildings for its needs for a period of two years.

Charles Abresch Co., 399 Fourth street, Milwaukee, manufacturer of automobile and truck bodies, machine work, etc., has increased its capital stock from $200,000 to $350,000 to enlarge its plant and business. Edmund H. Paul is secretary.

Commerce Motor Truck Co., Detroit, has acquired two more acres of ground at Mackie and Greene avenues and as soon as the present additions are completed it is expected that still more new manufacturing units will be constructed.

Parts Makers

Hayes Wheel Co., C. B. Hayes, president, is said to be forming a consolidation of practically all the wheel companies in that state, including the Hayes Wheel Co., the Prudden Wheel Co., the Auto Wheel Co., and the Gier Pressed Steel Co., of Lansing; the Hayes Motor Truck Wheel Co., of St. John; the Imperial Wheel Co., of Flint, and the Pioneer Pole & Shaft Co. and the Weiss and Loesch Co., of Piqua, O. The proposed consolidation contemplates a capitalization of $20,000,000 with headquarters at Jackson. The Hayes Wheel Co. is the largest of the interests involved, having a daily output of 5,000 sets of wheels and a business of $20,000,000 a year, and is the only one of the companies manufacturing steel and wire wheels. The Pioneer Pole & Shaft Co., manufactures rims and spokes, the Ohio companies in the proposed merger being the largest spoke manufacturers in the country.

Fairbanks, Morse & Co., manufacturer of cranes, engines, pumps and machinery, Chicago, will erect a $1,500,000 foundry at Beloit, Wis. The building will be 550 x 900 ft., and will contain 495,000 sq. ft. of floor space. The completed foundry will have a capacity of 400 tons of gray iron daily. Seventy electric cranes will move material to and from the eight cupolas which will be installed. Electric grab buckets will unload the molding and core sand and coke. Magnets will be used to remove the pig iron from the cars. The plans also provide for a ventilation system which will change the air in the foundry every 15 minutes; individual lockers for all workers; hot and cold showers for the entire force, and a modern cafeteria where the men can secure hot meals. C. A. Hardy, consulting engineer, Railway Exchange Building, Chicago, will design the plant.

Republic Tool & Mfg. Co., Cleveland, has been formed through a merger of the Cleveland Power Transmission Co., the Diamond Stamping Works, the Clyde E. Lowe Co., of Cleveland, and the Detroit Reamer & Tool Co., of Detroit. The company will have $500,000 capital stock divided into 5,000 shares of 7 per cent cumulative preferred stock of $100 par value and 15,000 shares of no-par common stock. Basic patents on pressed steel cores and steel mandrels have been acquired from the Clyde E. Lowe Co. and plans have been prepared for increasing the capacity of the Diamond Stamping Works. Executive officers of the new company are: Clyde E. Lowe, president; B. V. Selby, vice-president; E. H. Krueger, secretary; E. E. Lenarz, treasurer and general manager.

Norma Company of America, manufacturer of Precision Bearings, moved its factory, December 10, from The Bronx, New York City, to Anable avenue, Long Island City, N. Y., where a modern four-story reinforced concrete building has been acquired. Under the new arrangement a largely increased factory space is secured, making possible the increased output of bearings necessitated by the growing demand for these high-precision units. The new plant is being rapidly equipped with the special machines needed for precision manufacture, and the full capacity will be available shortly. The executive offices at 1790 Broadway have been consolidated with the factory at the new address.

General Top Co., Cleveland, O., has been organized with a capital of $1,000,000, and has taken over the assets and patents of the Consolidated Auto Top Co. Christian Girl, president of the Standard Parts Co., is connected with the enterprise as vice-president, and C. R. Norton, for many years general sales manager of the Packard Motor Car Co., of Detroit, is mentioned as its president. T. E. Borton, of Borton & Borton, a leading banking and investment house of Cleveland, will be treasurer. Norman Elliott, of the former Consolidated Top Co., is secretary.

Trailer Mfrs. Assn. of America has taken office and exhibition space totalling about 5,000 sq. ft. in the tractor, farm implement and trailer exchange established in Grand Central Palace, New York. The latest models will be shown in this seventh floor display by these members: Detroit Trailer Co. and Fruehauf Trailer Co., of Detroit; King Trailer Co., Ann Arbor, Mich.; Martin Rocking Fifth Wheel Co., Springfield, Mass.; Northway Trailercar Co., East Rochester, N. Y.; Ohio Motor Vehicle Co., Cleveland, and Rogers Brothers Co., Albion, Pa.

Astra Motors Corp., St. Louis, Mo., has been incorporated to manufacture the Astra car designed by Andre Mertzanoff. Arrangements have been made for the temporary use of the factory of the One-Wheel Truck Co. on Chouteau avenue. B. R. Parrott, recently with the Inland Machine Works, is president and treasurer. The factory plans an output of 25 cars in January, following three in December, and gradually working up toward a total of 3,599 in the 18 months beginning January 1, 1920.

Whiteley Malleable Castings Co., Muncie, Ind., denies a press dispatch that their plant is to be taken over by the Muncie Malleable Foundry Co., composed of Michigan capitalists. They report, however, that a Lansing corporation has been endeavoring to acquire a factory in Muncie or to establish a malleable iron works there. The Whiteley foundry manufactures steel and malleable iron castings for automobiles and airplanes.

Splitdorf Electrical Co. has moved its machine tool equipment, tools, dies, fixtures and stocks of raw and unfinished material from the plant at Sumter, S. C., to its large modern factory in Newark, N. J. This move does not indicate the discontinuance of the Sumter line of magnetos; it indicates quantity production of this equipment on a larger scale and by more modern methods than in the past.

American Hammered Piston Ring Co., Baltimore, Md., has sold its former plant at 700 South 11th street, Newark, N. J., to the Qualitoy Co., a new organization, which will equip it for the manufacture of mechanical and other toys. The factory is one-story brick, 125 x 246 ft. Morris Fisher is vice-president of the purchasing company, and Frank Torre is secretary.

Oil Engine Works of Canada, 29 Prince street, Montreal, will shortly move its plant to Iberville, Que., where it will occupy a portion of the Rapid Tool & Machine Co. plant. Its machine work on the six and eight horsepower Hvid oil engines, formerly contracted for, will be largely done at its new assembling plant. M. L. G. Vincent is managing director.

Hoover Steel Ball Co., Ann Arbor, Mich., has acquired the plant and going business of the Chelsea Steel Ball Co., Chelsea, Mich., and has taken possession. The new plant will concentrate on the production of the cheaper grade of steel balls, for which there is a big demand, leaving the original Hoover plant to continue with the production of the higher grades.

Swan & Finch Co., New York, has purchased the Cataract Refining & Mfg. Co., Buffalo. The Cataract company has operated large lubricant plants in Buffalo and Chicago and maintained

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branch offices and warehouses in eight principal cities in the United States and four in Canada and Great Britain.

Briggs & Stratton Co., Milwaukee, manufacturer of automotive equipment, parts, ignition devices and motor wheels, has increased its capital stock from $250,000 to $1,700,000. It has an extensive plant enlargement program involving a total expenditure of $1,000,000. Stephen B. Briggs is president.

Gove Motor Works, Fremont, Neb., has completed plans for a factory to cost $225,000. Work on the new buildings, which will turn out automobiles and tractors, will begin early in the spring. Denver, Col., and Pocatello, Idaho, business men are associated with Mr. Gove.

Milwaukee (Wis.) Auto Engine & Supply Co. has let contracts for a one-story brick and steel machine shop addition, 120 x 120 ft., at 30th street and North avenue. It manufactures ignition devices and other gas engine parts and specialties. Ben D. Zimmerman is president.

Root & Van Dervoort Engineering Co., Moline, Ill., engine manufacturers, has purchased the plant of the Root & Van Dervoort-Wagner Ordnance Co., which adjoints its own buildings. The object is to obtain increased facilities for expansion of output.

American Bosch Magneto Corp., 223 West 46th street, New York, has acquired property, 73 x 100 ft., on 60th street, near Broadway, as a site for a new building. It is planned to construct a ten-story factory and salesroom, with estimated cost at $700,000.

Motive Products Corp., Bridgeport, Conn., has been incorporated with a capital of $300,000 by L. C. Held and L. E. Disbrow, Bridgeport, and Jonathan Grout, 886 Main street, Fairfield, Conn., to manufacture roller bearings and similar specialties.

McLaren Rubber Co. is the new name of the J. & D. Tire Co., Charlotte, N. C., control of which has passed to H. L. McClaren, now its president and treasurer. The plant will be materially increased so as to provide a much larger output.

Racine-Sattley Co., gas and gasoline engine and agricultural implement manufacturer, Springfield, Ill., has been granted a permit to construct a $400,000 plant in that city, which, when equipped, will represent a total investment of $850,000.

Bethlehem (Pa.) Spark Plug Corp. has been incorporated in Delaware with capital stock of $10,000,000. The new organization will succeed the Silvex Co. and will build a large addition to the present plant. E. H. Schwab is president.

Franklin J. Groth, Toledo, O., will establish a plant at Indianapolis for the manufacture of leaf springs for automobiles. The main building, 60 x 500 ft., will be at St. Paul street and the Cincinnati division of the Big Four Railroad.

Canton-Detroit Foundry Co., Canton, O., has been incorporated with a capital stock of $50,000 and has purchased the plant of the F. B. Widder Foundry Co., which will be remodeled for making steel castings for the automobile trade.

Auto Truck Service Co., 946 Third street, Milwaukee, will build a new plant costing $50,000 for the manufacture of a mechanical hoisting appliance for motor trucks and other motor truck devices. Theodore Hollnagle is president.

Enterprise Machine Co., Beaver Falls, Pa., has commenced the enlargement of its plant and will install new equipment, including lathes. It is specializing in the production of automobile parts. C. A. Spickerman is president.

Northern Wheel Co., Alma, Mich., a recently organized corporation, will soon break ground for the first unit of its plant to be used for the manufacture of wheels for automotive vehicles. The building will be 60 x 300 ft.

Allied Automotive Corp., Mineola, N. Y., has been incorporated with a capital stock of $250,000 by W. E. Kisselburg, J. F. Egan and E. E. Gilman, 149 Broadway, New York, to manufacture automobile and other motors.

Wire Wheel Co. of America, Elmwood avenue, Buffalo, manufacturer of motor car wheels, in addition to the extension now in course of erection, has had plans prepared for four other buildings to be constructed later.

Cotex Co., manufacturer of artificial leather, Newark, N. J., recently filed plans for the erection of a two-story brick factory at an estimated cost of $10,000. The new building is to provide for increased capacity.

Vita Mfg. Co., Cleveland, will erect a factory 132 x 252 ft., at Madison avenue and West 117th street, Cleveland, to manufacture the Rogers magneto. George D. Rogers is president and Charles Ammerman, secretary.

Kellogg Mfg. Co., 3 Circle street, Rochester, N. Y., manufacturer of air pumps, is having plans prepared for a one-story machine shop, 200 x 800 ft., on Humboldt street, to cost about $200,000, including equipment.

Aluminum Co. of America, 120 Broadway, New York, with headquarters at Pittsburgh, manufacturer of aluminum products, has awarded a contract for a three-story addition, 125 x 300 ft., at Edgewater, N. J.

Prest-O-Lite Co., Indianapolis, Ind., manufacturer of acetylene tanks and equipment, has acquired a tract of about seven acres on Avenue R, near the Newark Transfer, Newark, N. J., as a site for a new plant.

John A. Roebling's Sons Co., South Broad and Canal streets, Trenton, N. J., manufacturer of wire, wire rope, etc., has filed plans for a two-story building on South Clinton avenue, to cost about $20,000.

Balanced Valve Motor Co., Milwaukee, a new $1,000,000 corporation, has opened temporary offices and factory at 244 Oregon street, and next spring intends to erect a plant. William M. Baumheckel is president.

Firestone Tire & Rubber Co. is to build a $5,000,000 plant at Hamilton, Can. The Canadian factory will employ 2,000 persons and have a capacity of 3,500 tires daily. Building will start within five months.

Hlee Products Co., Lowell, Mass., with a capital of $50,000, has been chartered to make motor accessories, vehicles, combustion engines and equipment. Harley E. Cover, 20 Grand street, Lowell, is president.

Liberty Auto Ignition Co., New York, has been incorporated with a capital stock of $150,000 by H. Eissenbach, L. Kretzer and L. Baskin, 1121 Tinton avenue, Bronx, to manufacture ignition equipment.

Twin Disc Clutch Co., Racine, Wis., is enlarging its business and has increased its capital stock from $100,000 to $150,000. It manufactures steel disc clutches for automobiles, trucks and tractors.

Superior Motor Parts Co., Pittsburgh, has been incorporated with a capital stock of $25,000 by W. A. Wilson 1624 Wightman street, Pittsburgh; G. M. Metz, Aspinwall, Pa., and W. T. Hughes, Wilkinsburg.

Fairfield Mfg. Co., Lafayette, Ind., has been incorporated with $150,000 capital stock to manufacture motor vehicle parts. The directors are David L. and Edward A. Ross and George C. Kumming.

W. J. Murray Mfg. Co., Detroit, manufacturer of sheet metal product for the automobile industry, will establish a plant in Cleveland, and will shortly begin the erection of a two-story factory.

Boyce Veeder Corp., New York, has been incorporated with a capital stock of $75,000 by H. H. Boyce, P. L. Veeder and J. W. Truesdale, 259 East 82d street, to manufacture fire extinguishers, etc.

Edelman Mfg. Co., 361 East Ohio street, Chicago, manufacturer of automobile products, will erect new one-story plant at 2638-56 North Crawford avenue, to cost about $175,000, including equipment.

Robert Erlichman and Frank S. Mickley, Allentown, Pa., operating a company for the manufacture of compressors, piston rings, etc., are considering the establishment of a plant at Bethlehem, Pa.

Montgomery, Ward & Co., Chicago, are constructing a $400,000 addition to their works at Springfield, Ill., to house the farm gas engine factory. The plant is located at Eleventh and Ash streets.

Byron Engineering Works, Louisville, Ky., has been incorporated to manufacture two new forms of trailers. A two-acre site for a modern plant has been secured. Greene McGowan is president.

Van Sicklen Speedometer Co. will locate a $3,000,000 plant at Elgin, Ill., the city having complied with the stipulation of the company that 500 dwellings be built within a limited period.

Cotta Transmission Co., Rockford, Ill., is not alone the largest exclusive manufacturer of truck and tractor transmission but is planning further large expansion in buildings and personnel.

Durston Gear Corp., Syracuse, N. Y., has doubled the size and capacity of the plant and have added to an already complete line a new model transmission with many up-to-date features.

North East Electric Co., 348 Whitney street, Rochester, has awarded contract for a factory addition, 86 x 198 ft., two stories, at Lyell avenue and Whitney street, to cost $60,000.

New London (Conn.) Ship & Engine Co. has just closed a large order for oil burning engines for commercial use, which are twice as large as any the company made during the war.

Columbus (O.) Metal Products Co., maker of automobile and other specialties, has increased its capital stock from $10,000 to $30,000 and will add to its manufacturing facilities.

Metal Hose & Tubing Co., 253 Tillary street, Brooklyn, has had plans prepared for a three-story plant, 48 x 100 ft., at Raymond street and Park avenue, to cost about $75,000.

Marlin-Rockwell Corp., Philadelphia, has disposed of its plant at Milnor and Devereaux streets, Tacony, on a five-acre site, to E. S. Lewis, Philadelphia, for about $130,000.

Herschell-Spillman Co., North Tonawanda, N. Y., manufacturers of automobile engines, has awarded contract for a three-story reinforced concrete addition to cost $75,000.

Bagg Steel Wheel Corp., Buffalo, N. Y., has been incorporated by C. M. Bagg, 85 Woodbridge avenue, F. C. Schoenthal and T. F. Hogan, with a capital stock of $200,000.

Columbus (O.) Auto Parts Co. has increased its capital stock from $150,000 to $300,000, and will enlarge its plant for the manufacture of automobile accessories.

Stromberg Motor Devices Co., 68 East 25th street, Chicago, is erecting a seven-story plant 75 x 125 and 192 ft., at Wabash avenue and 25th street, to cost $280,000.

Raybestos Co., Bridgeport, Conn., manufacturer of brake lining, etc., for automobiles, has awarded contract for the erection of a one-story addition, 90 x 160 ft.

Tuthill Spring Co., 760 Polk street, Chicago, automobile and truck springs, contemplates erecting a two-story plant and office building 212 x 418 ft., to cost $200,000.

C. A. S. Products Co., Columbus, O., maker of automobile parts, has commenced the erection of an addition to its plant on East Second avenue, 40 x 100 ft.

Convertible Tractor Corp., of St. Paul, Minn., contemplates the erection of a plant for the manufacture of their tractor attachments at Goderich, Ont.

Kolben Wire Wheel Co., Cadillac, Mich., has broken ground for its new plant. As soon as this is completed the Detroit plant will be moved to Cadillac.

Optimo Disc Wheel Corp., Buffalo, manufacturer of metal wheels for automobiles, has filed notice of change of name to the Multi Disc Wheel Corp.

Burd High Compression Ring Co., Rockford, Ill., has recently completed factory additions which will more than triple the production capacity.

Hess-Bright Mfg. Co., Front and Erie streets, Philadelphia, manufacturer of ball bearings, is planning for a two-story plant addition, 42 x 105 ft.

Corcoran-Victor Co., Cincinnati, maker of automobile lamps and other specialties, has let contract for an addition to its plant on Reading road.

Cutten & Foster, 302 Church street, Toronto, manufacturer of automobile tops, etc., will build an addition to their factory to cost $40,000.

Oliver Rim Co., Atlanta, Ga., will build a plant, 90 x 160 ft., and install stamping and rolling machinery. V. G. Collins is manager.

Johnson Rim & Parts Co., Buffalo, manufacturer of automobile parts, etc., has increased its capital stock from $50,000 to $250,000.

Rochester (N. Y.) Motors Co., Inc., 609 Driving Park avenue, will build a one-story machine shop addition, 100 x 390 ft.

Michigan Crankshaft Co., Saginaw, Mich., has started work on a concrete and steel plant, 165 x 690 ft., to cost $600,000.

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Torbensen Axle Co., Cleveland, has had plans prepared for an addition providing 15,000 sq. ft. of floor space.

Greene Engineering Co., Dayton, O., manufacturer of alumnite pistons, has let a contract for a new factory.

Empire Axle Co., Dunkirk, N. Y., will build a one-story brick and steel addition, 82 x 200 ft., to cost $30,000.

Federal Bearings Co., Poughkeepsie, N. Y., has increased its capital stock from $1,000,000 to $2,000,000.

Money Metal Products Corp. is the new corporate name of the Bayonne Casting Co., Bayonne, N. J.

Timken Roller Bearing Co., Canton, O., plans shortly to erect an addition to its tube mill.

K-W Ignition Co., Cleveland, is planning the erection of an extension 70 x 140 ft.

Body Builders

Ford Motor Co.'s body plant, now housed in the buildings formerly used for shipbuilding work, will soon be the largest body plant in the world. An ultimate output of 2,000 bodies daily, or 600,000 a year is the announced plan. Approximately 5,000 men are employed, but it is announced that this force will be increased to between 12,000 and 15,000 within the next six months. With 15,000 men in the body plant and blast furnaces, 55,000 in the automobile factory at Highland Park, 5,000 at the tractor plant at Dearborn, and approximately 10,000 in the various branches scattered throughout the country, Ford employes total approximately 85,000 in the United States. At present the Fisher Body Corp. is making open and closed bodies for Ford to supplement the 800 open bodies manufactured daily at the Ford plant. The Wadsworth Mfg. Co. will build the closed bodies as soon as its factory, destroyed by fire, has been rebuilt, and Fisher then will furnish only the open bodies necessary in addition to the Ford output.

Anheuser-Busch Brewing Assn., East St. Louis, has given over a large four-story building to the manufacture of motor truck bodies. The plant in which the new body building is being done was formerly used by Anheuser-Busch to build bodies for the trucks it used in its own work. The structure is especially adapted for such work, the floors being carried on concrete girders with 65 ft. spans, eliminating obstructing columns. Martin Kurz, who was in charge of the plant when only Anheuser-Busch work was being done there, has been placed in charge.

Lang Body Co., Cleveland, O., has found it necessary to triple its manufacturing capacity. An additional plant, providing approximately 105,000 sq. ft., is now under construction at a cost estimated at $275,000. The main building of the new group is 263 x 63 ft., four stories high, with a wing 100 x 80 ft. of the same height. There is also a one-story structure 188 x 61 ft. This expansion is the more noteworthy when it is considered that the Lang company has been working on private contracts less than a year.

Mueck Auto Body Co., St. Louis, for the third time in three years, has found it necessary to enlarge its plant. A steadily increasing demand for special bodies for passenger cars has influenced the company to erect an addition to its plant, two stories high, on a plot 55 x 75 ft. Among the company's recent work has been the building of bodies for the new passenger car to be produced by the St. Louis Car Co. in that city.

Everett Bros., Detroit, automobile body builders, have purchased the factory and real estate of the Murphy Chair Co., the transaction involving approximately $1,500,000. The factory contains about 550,000 sq. ft. of floor space and covers 12 acres. The present business of Everett Bros., now housed in five plants, will be centralized in the new factory and the output greatly increased.

Ashton-Kramer Co., coach builders, on November 15, removed from 1615 Michigan avenue, Chicago, to Mishawaka, Ind. This company has been purchased by Kenyon W. Mix, vice-president of the Dodge Mfg. Co., which, it is reported, is closely allied with the new car which C. Y. Kenworthy is going to produce under his own name. Chas. Kramer, designer for Ashton-Kramer, will remain as secretary and general manager.

Bosworth-Ard Machine & Foundry Co. have purchased the plant, machinery, equipment and material of the Hale Buggy Mfg. Co., 310 West 15th street, Anniston, Ala., and will operate the plant under the name of the Anniston Truck & Body Co. The new company will manufacture truck bodies and automobile tops, and will also handle automobile accessories for resale.

Schmidt & Stork Wagon Co., West Bend, Wis., has decided to build a big, new modern plant. With this idea in view a tract of four acres has been purchased adjoining the Chicago & Northwestern Railway, the capital stock increased to $150,000, and work on the new plant started. This firm is a very old one, and was established more than 30 years ago.

Ohio Body & Blower Co., Cleveland, has disposed of the offering of stock recently made for the purpose of financing the handling of part of the body business now being offered it in the Cleveland territory. When plant extensions now planned are completed, the company will have a capacity of 30,000 automobile bodies per annum.

Bela Body Co., Framingham, Mass., had all of its employes go out on strike recently because they were refused time and a half for three additional hours work weekly, resulting form the change, as of November 26, from a 45 to 48-hour week. The company agreed to pay straight time, but the workers refused this.

J. L. Clark Mfg. Co., Oshkosh, Wis., has increased its capital stock from $150,000 to $200,000. It has completed its reorganization from a carriage manufacturer to a producer of automobile bodies, motor truck cabs, etc. W. E. Muir is secretary and treasurer.

McCord Mfg. Co., Inc., has acquired the business of the Racine (Wis.) Mfg. Co., maker of automobile bodies and accessories. This purchase gives the McCord company seven places in this country and Canada.

Smith-Springfield Body Co., Springfield, Mass., has filed application for a permit to build a plant in West Springfield at a cost of $42,000. It will build a factory, steam plant and dry kiln.

Mack Body Co., Lancaster, Pa., was partly burned out late in November, and with the Queen Motor Co. sustained a loss of about $75,000.

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PATENTS

Patents—H. W. T. Jenner, patent attorney and mechanical expert, 622 F St., Washington, D. C. Established 1883. I make an examination and report if a patent can be had and exactly what it will cost. Send for circular.

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The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

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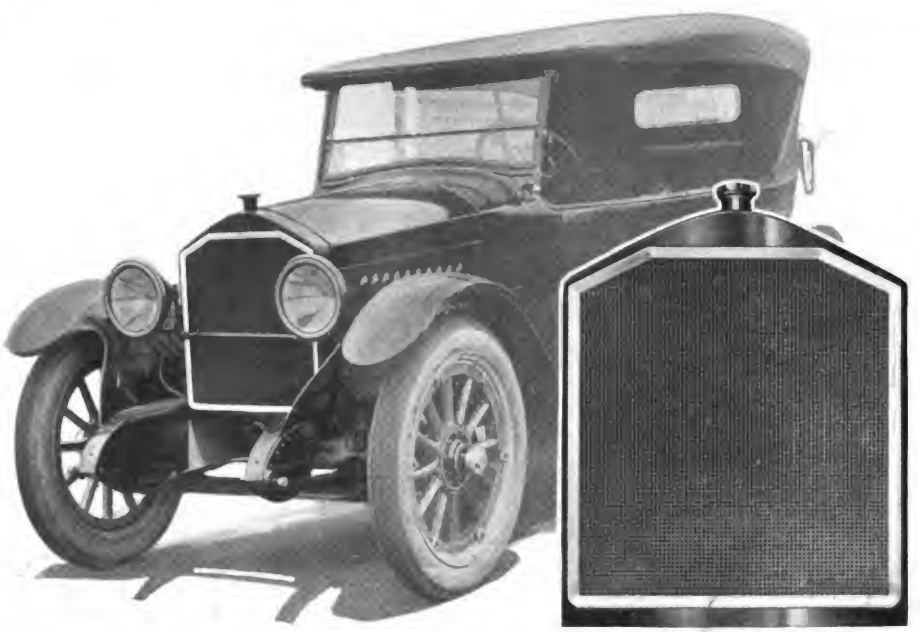
Vol. LXI, No. 10 NEW YORK, JANUARY, 1920 $2.00 Per Year Issued Monthly



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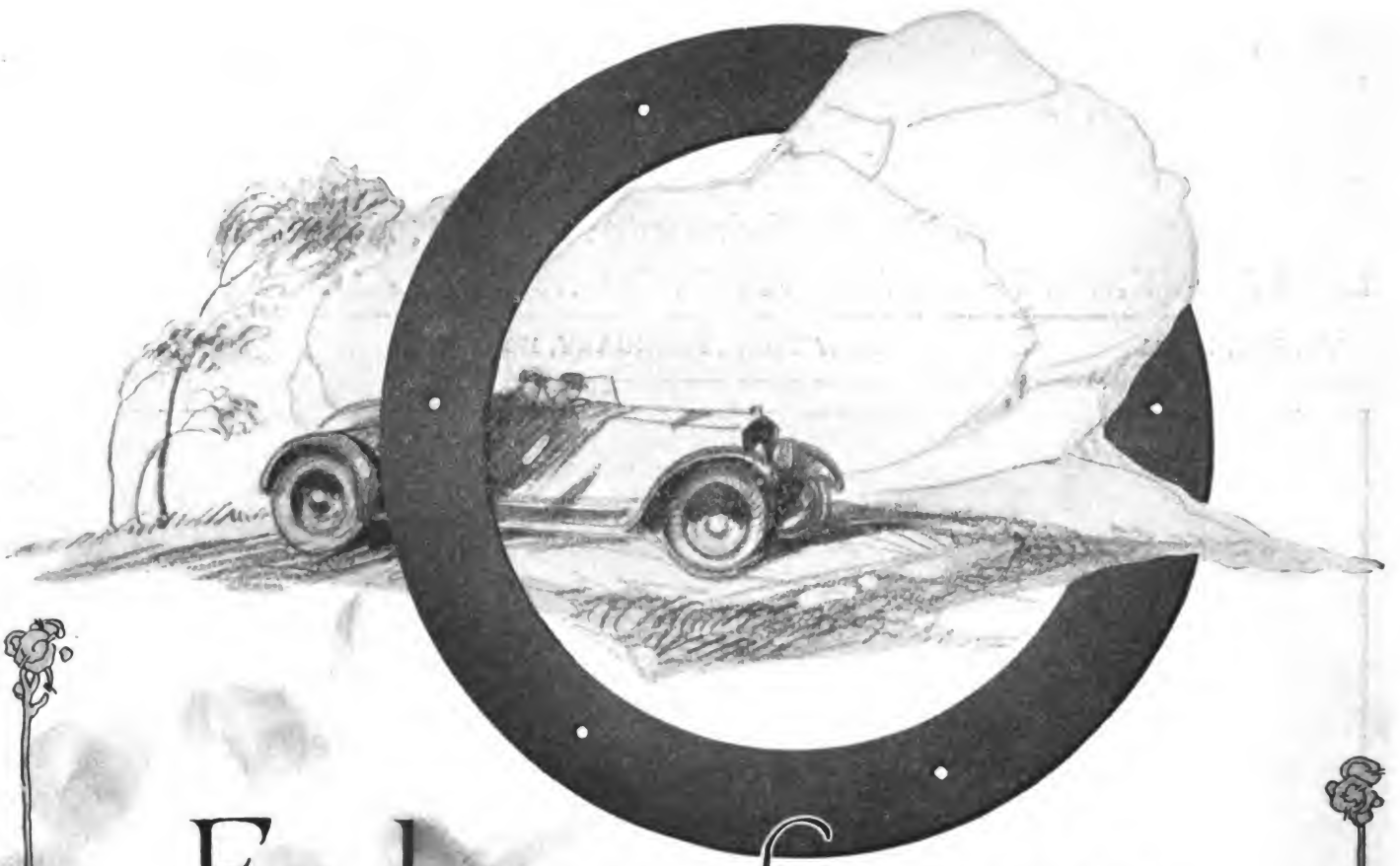

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The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXI NEW YORK, FEBRUARY, 1920 No. 11

Modern Tendencies in Engine Design*

By L. H. POMEROY†

Overhead Valve Advantages and Disadvantages, Methods by Which Efficiency Could Be Increased, Present Sources of Loss, Saving Weight in Pistons, etc.

WE have in an ordinary gas engine a loss of about 9 per cent of the heat supplied in the first 30 per cent of the stroke, or that part in which the combustion chamber shape is most important. This is so little as to render considerations of the combustion chamber shape of secondary importance in respect to the jacket loss and has led more than one designer astray in his search for high mean effective pressures and thermal efficiencies in gasoline engines. In my view, the attitude of indifference of many designers to thermodynamic problems is because the facts of the gasoline engine do not square with the theories of the gas engine, and these are largely reconciled if the considerations already mentioned in respect to combustion chamber design are kept in mind. Briefly, the factors governing combustion chamber design are, first, compact geometrical shape; and, second, provision for adequate valve area.

Arguments for the Overhead Valve

The strongest argument in favor of the overhead-valve engine is its ability to burn the maximum proportion of the fuel supplied owing to the compact combustion chamber inherent in this valve system, the superior orifice coefficiency of the overhead valve being freely granted as against that of the ordinary pocket-located inlet valve. There is reason to believe, however, that a side-by-side valve engine can be designed in which the turbulence effect is even greater than in an overhead-valve engine, so that the extremes may meet. My experiments convince me that for engines of 40 to 60 cu. in. per cylinder a pocket-located valve will allow for a combination of this turbulence without any sacrifice of volumetric efficiency up to 3,000 r.p.m., which is high enough for the present. It is significant that, after ten years or more of intensive high speed engine design, there is no fixed opinion upon valve location, and that the manufacturers with the greatest experience with overhead valves do not use them in touring car engines. In this connection it must be remembered that the question of side-by-side valve versus overhead valve is not necessarily determined on the grounds of efficiency and power alone. The purchasing public, who, after all, are the final arbiters in the matter, will give short shrift to thermodynamic perfection if this is accompanied by personal discomfort. As the ability of an engine to behave itself perfectly at low engine speeds and to possess great flexibility is not the least of the qualities demanded by the user, it must be pointed out that compact combustion chambers, such as arise naturally in the design of overhead-valve engines, are prejudicial to sweetness of running, particularly at low speeds and part throttle. Not the least virtue in respect to the orthodox side-by-side valve engine is the fact that the film of gas in contact with the comparatively cold walls of the combustion chamber burns during the expansion stroke with a quasi-Diesel effect, so that an indicator diagram taken under these conditions has a rounded top. This largely accounts for the popularity of the side-by-side-valve engine in spite of the deliberate sacrifice of economy and power.

Improvements in Mechanical Efficiency

There is room for much experiment along the lines of a compact combustion chamber, combined with a design in which the preservation of the cold gas film is realized, so that the best compromise between flexibility, power and efficiency can be obtained. All that can be said at present is that both side-by-side and overhead-valve engines represent opposite extremes, each introducing undesirable characteristics. In the light of recent research, I am inclined to think that it is going to be much easier to make the side-by-side valve engine more efficient and powerful than to make the overhead-valve engine sufficiently flexible. However, the ultimate type may quite conceivably be determined by secondary considerations, such as manufacturing convenience, silence and general appearance.

The mechanical efficiency of gasoline engines has been

*Continued from page 26, January issue.
†Consulting engineer, Cleveland, O.

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investigated by many workers and the records of engineering societies are full of data thereon. As far back as 1907, Professor Hopkinson at Cambridge University measured the mechanical efficiency of a four-cylinder Daimler engine by an optional indicator and one of his assistants, Mr. Morse, evolved the method that is so largely used today of measuring mechanical efficiency by cutting out one cylinder of a multi-cylinder engine and finding the torque exerted by the remaining three. The difference at the same speed between the torque of three cylinders and that of four in a four-cylinder engine is the indicated torque of the non-firing cylinder, thus allowing the relation between brake horsepower and indicated horsepower to be measured with four readings. The analysis of frictional losses of gas engines was also investigated by Hopkinson, and those of high speed gasoline engines by Riedler in Germany, to mention only two of many investigators.

The overall mechanical efficiency of both gas and gasoline engines was found to be remarkably independent of their relative sizes, being about 85 per cent in large gas as well as in small multi-cylinder gasoline engines. Great falling off in the mechanical efficiency of the gasoline engine with increase in speed was, however, apparent.

In my opinion it is most unfortunate that mechanical losses have to be subdivided into those arising from gas friction and bearing friction, but the definition is too well established to be worth contesting. The gas friction or pumping losses may therefore be discussed first. These, it is well known, arise from the friction due to ports and valves, both intake and exhaust. In the normal gasoline engine the gas flow into the cylinder is due to the difference between the pressure in the cylinder and that of the atmosphere. It is also possible to have two engines of equal volumetric efficiency, but in which the work done by the piston in charging the cylinder may be widely different. A late opening and closing inlet valve will give a suction diagram somewhat like Fig. 4. An earlier opening valve (See Fig. 5) will reduce the area of the suction loop very considerably and improve performance to the extent indicated by the difference in the negative work areas.

The combination of decreased gas velocities in inlet valves and manifolds, together with a better understanding of the phenomena associated with the induction stroke, has had a very pronounced effect upon the mechanical efficiency of the gasoline engine at high speeds, which can be counted on nowadays to be well over 80 per cent at 2,000 r.p.m., a result obtained ten years ago only at speeds well under 1,000 r.p.m.

The back pressure due to the exhaust should also be mentioned if only to point out its relative unimportance owing to the rapid escape of the exhaust gas when the exhaust valve is opened. Further, it is easy to arrange exhaust pipes so that there may actually be a negative pressure in the cylinder toward the end of the exhaust stroke. The all-important point is that exhaust gas under pressure is not trapped in the combustion chamber when the valve closes. With valve areas such that gas velocities do not exceed 300 ft. per second, the influence of gas friction upon mechanical efficiency is not of much account, nor is it susceptible of much reduction. The frictional resistance of the carbureter itself is usually far in excess of the inlet port and valve friction in the practical case and has to be tolerated to get efficient carburetion.

What the Big Losses Are

Leaving the question of fluid friction losses and passing to those more purely mechanical, these may be divided as follows:

1. Losses due to driving auxiliaries, such as the fan, the water pump, the oil pump, and the electrical equipment.
2. Losses due to bearing friction of the crankshaft, the camshaft, the valves, the gears, etc.
3. Piston friction.

The losses due to driving the water and oil pumps and electrical equipment are negligible in most cases. The loss due to driving the fan, particularly at high speeds, is however considerable, easily amounting to from two to three h.p. at 2,500 r.p.m. It is noteworthy that the vast majority of designers employ gears to drive the water pumps which are often larger than those in the transmission, but are quite content to drive the fan by a belt, in spite of the fact that the fan absorbs about 40 times the power required to drive the pump.

It has been known for many years that the friction of a well designed journal bearing is exceedingly small, but it seems to have taken a long time to make the logical

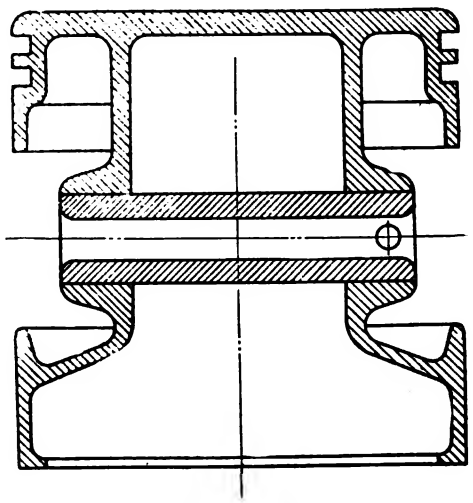

Fig. 6—Section through Zephyr type of piston

deduction that if the journal friction in a gasoline engine is small and the total friction absorbs some 10 per cent of the indicated horsepower, a large proportion of this must be charged to friction between the piston and the cylinder walls. It has taken still longer to seriously attack this problem of reducing piston friction.

In gasoline engines with cast iron trunk pistons, the piston friction is about 8 lbs. per sq. in. of piston area at a piston speed of 2,000 ft. per minute. The magnitude of this quantity depends upon the piston thrust and rubbing velocity, the former item being very largely a function of the inertia pressure. Reduction of piston mass is obviously the first step in reducing piston friction. The advantages of the aluminum piston in this respect are apparent. It is not generally appreciated that the prime virtue of light reciprocating parts is the improvement of mechanical efficiency caused thereby, and that, apart from this, the net energy absorbed in reciprocating a piston is the same for heavy pistons as light, being nil.

The next point of importance is the consideration of the action between the rubbing surfaces of the piston and the cylinder wall. In the case of a trunk piston of normal design it is easily seen that the area of the oil film be-

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tween these surfaces is equal to the wall area of the piston, and that as only one side of the piston is functioning at a time there is roughly four times more oil film being acted upon than is required for taking the piston thrust, which probably does not extend to more than one-quarter of the piston circumference. This unnecessary surface in contact is naturally prejudicial to mechanical efficiency. For this reason many pistons are relieved for part of their length by reducing the diameter about the piston pin and are also drilled to reduce the surface in contact. The advantages obtained are real and distinctly shown on the test bench. Unfortunately, it has been found difficult to combine mechanical strength with lightness in these pistons and many failures have resulted from such attempts to sidetrack the defects of the piston of standard design. Further, the disposition of the bearing surface in pistons so relieved is not correct. There is still a 50 per cent excess of unnecessary surface, allowing for the fact that bearing surfaces have to be provided on each side of the piston, although only one side functions at a time. The rigidity of the piston-pin bosses is also seriously reduced unless the piston walls are unduly heavy. The orthodox trunk piston has been regarded by designers in much the same way as the flatness of the earth was regarded by the world in general before the voyage of the first American immigrant. It has simply been accepted without question. The success attending the various departures from orthodox construction is a very useful object lesson that no established construction is beyond improvement.

One of the earliest of these departures is the Zephyr piston shown in Fig. 6. This type of piston has been very successful in aeronautic and racing engines, some of the first specimens being used by me on racing cars in 1912. In addition to the reduced bearing surface and adequate piston-pin boss support, it will be noticed that the

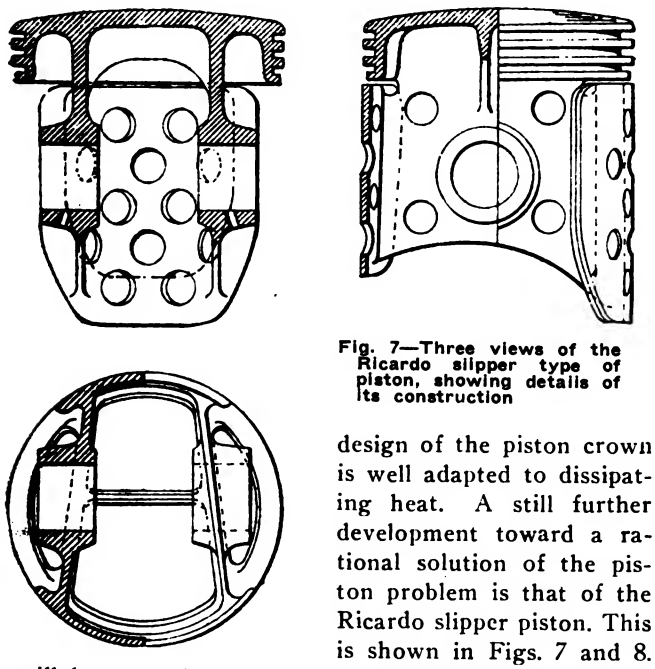

Fig. 7—Three views of the Ricardo slipper type of piston, showing details of its construction

design of the piston crown is well adapted to dissipating heat. A still further development toward a rational solution of the piston problem is that of the Ricardo slipper piston. This is shown in Figs. 7 and 8. It will be seen that there are a considerable number of interesting points in this design, which can be tabulated as follows:

1. The direct transmission of piston thrust to the slippers.
2. The proportioning of the slippers to the loads they carry, the compression slipper being reduced in area compared with that receiving the explosion thrust.
3. The slippers extend the whole working length of the piston and only laterally to the degree required.
4. Rigid support of the piston-pin bosses.
5. The ability to use a floating piston pin.
6. Inherent lightness.

The improvement in power and reduction of gasoline consumption consequent upon the improved mechanical efficiency obtained with this type of piston varies from 5 to 10 per cent at full load and is highest at high speeds. When it is remembered that an automobile engine is only

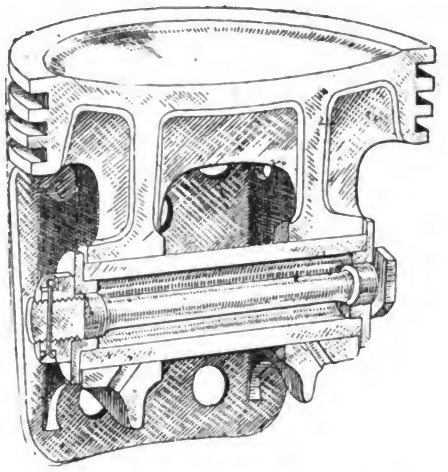

Fig. 8—Vertical section through Ricardo piston showing method of retaining wrist pin

developing about 25 per cent of its maximum power during a large percentage of running, and that under these conditions the inertia force and speed elements of piston friction are fully manifested, it will be seen that the effective increase in mechanical efficiency at low loads and high speeds may be very considerable.

For example, about 10 h.p. is required to propel a car weighing 3,000 lbs. at a speed of 30 m.p.h., with a gear ratio of 5.01; this corresponds to an engine speed of about 1,550 r.p.m. at which speed an engine of, say, 200 cu. in. capacity is easily capable of developing some 36 h.p. The load factor, according to the conditions stated, is, therefore, only about 28 per cent. The well known law of friction of machines, that friction is independent of the load, is as applicable to gasoline engines running at constant speed as it is to the hand crane or pulley blocks of our school laboratories, especially as in the case under discussion the bulk of the loading is due to inertia effects which are constant by hypothesis.

A very fair upper limit for the mechanical efficiency of a 200 cu. in. engine with cast iron pistons running at 1,500 r.p.m. is 87 per cent. The corresponding figure with slipper-type pistons may easily be 92 per cent. The friction horsepower for cast iron pistons is, therefore, $\frac{36}{87} - 36 = 5.2$ h.p., and for the slipper pistons $\frac{36}{92} - 36 = 3.2$ h.p.

As this friction loss is virtually independent of the load, it will be the same when the engine is delivering the 10 h.p. at 1,500 r.p.m. as when delivering the maximum horsepower of 36 at this speed. The mechanical efficiency with cast iron pistons, the engine delivering 10 h.p., will, therefore, be 66 per cent, while with the slipper piston the corresponding mechanical efficiency will be 76 per cent, an improvement of over 15 per cent at 28 per cent of full load,

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arising from an assumed improvement of 5 per cent at full load. In actual practice, the improvement at full load is usually far more than 5 per cent, as few engines with cast iron pistons have a mechanical efficiency of 87 per cent, thus enhancing the corresponding item under ordinary running conditions. The increase in mechanical efficiency is obviously accompanied by a decrease in gasoline consumption of exactly the same percentage.

In brief, this piston satisfies admirably the essential conditions of inherent lightness due to the correct disposition of material, in itself no small economic advantage, together with the realization of a very high standard of mechanical efficiency. It is also found to be free from the defect of oil pumping, and very low oil consumptions have been obtained in actual use. In two cases within my knowledge the oil consumption of a sporting four-cylinder car with an 80 mm. bore by 180 mm. stroke engine was 4,000 to 5,000 miles per gal. Similar results have been obtained

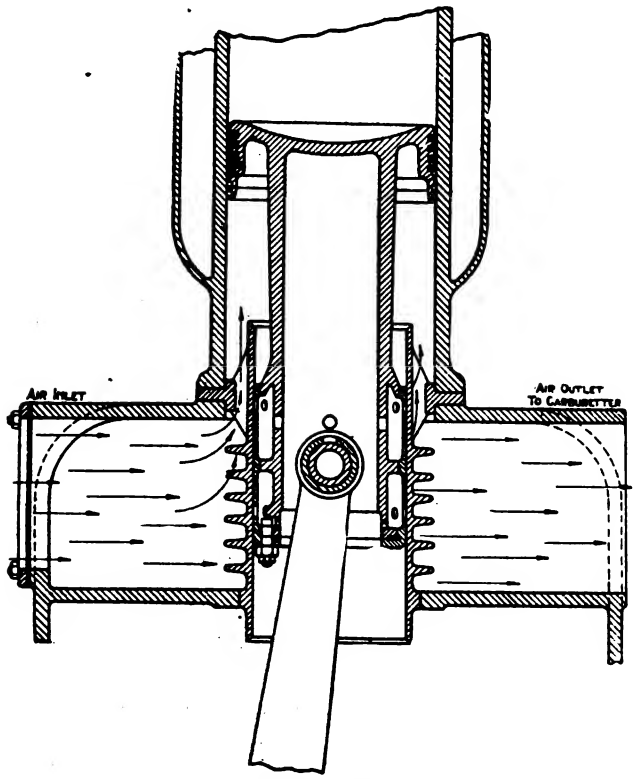

Fig. 9—Ricardo crosshead type of piston which has shown even greater efficiency and economy

by its use on truck engines, one large omnibus company recording a decrease in oil consumption of 80 per cent as compared with results previously obtained when cast iron pistons were used.

Still greater improvements in mechanical efficiency, thermal efficiency and oil consumption have accompanied the use of the Ricardo crosshead-type piston illustrated in Fig. 9. It will be seen that this piston resolves itself into two parts, one, the crown carrying the piston rings and performing the essential function of preventing gas leakage; the other the crosshead which takes the connecting rod thrust. As the crosshead part is working in a guide that is kept cool by the flow past it of the air on its way to the carbureter, and is also ideally lubricated, the working clearance can be reduced to very fine limits so that the piston is absolutely silent. It further insulates the crankcase from the heat radiated from the piston, thus keeping the lubricating oil cool. The supply of oil to the cylinder walls can be precisely regulated and is exceedingly small in quantity, as the top of the piston does not perform any thrust-resisting functions. Further, the crankcase may be filled to the level of the crankshaft without increasing the amount passing to the cylinder walls. The net result is a very low oil consumption of 0.01 pint per b.h.p.-hour in a 200 h.p. engine at full load. There is also an almost complete absence of carbonization. The official report of a British government department on an engine with this type of piston stated that at the end of a 400 hour run the carbon could be rubbed off piston by the fingers.

It is also a most interesting and important characteristic of engines with this type of piston that while at full load the temperature of the air in the region of the crosshead guide is about 70 deg. F. above atmospheric temperature, falling to that point before entering the cylinders; at light load the respective temperatures are about 90 and 30 deg. F. above atmospheric temperature, thus giving the ideal conditions for prevention of gasoline condensation at low loads and speeds, and when idling. The use of heated manifolds, hot spots, etc., is thus rendered unnecessary.

A tank engine was fitted with these pistons and forced to run supported at an angle of about 45 deg. with the ground. In this position the engine was required to run light for 30 minutes and then to open up immediately without smoking.

In the foregoing remarks on mechanical efficiency adequate lubrication has been assumed. The relative merits of the various systems in use do not seem to have changed much and it is impossible to say that any particular one is greatly superior to the others. The system that is adopted seems to be largely a matter of taste, which indicates the verification by experience of the doctrine that a correctly designed bearing will lubricate itself if oil is led to it.

Under no circumstances is it likely, in gasoline engines, that a bearing can be oil-borne by the pressure in the oiling system. On the other hand, the advantage of forced lubrication in cooling heavily loaded bearings by sheer volume of oil pumped is not to be lightly set aside.

(To be continued)

Examples of Fine Coach Work

On the facing page are presented two samples of recent fine American coach work, a coupe and a sedan, both for four passengers. The former is a Locomobile product, was built for Mrs. W. Gunby Mitchell, of Birmingham, and is painted cobalt blue. The whole car is motivated in blue and white. The front seats are done in long grain blue leather. The tire covers at the rear are blue with white tread. The interior is upholstered in blue velvet; hassock cushions and carpets are also blue. The vanity case is all mahogany inlaid with silver. The fittings of this vanity case, together with all the various watch faces, telephone plates, door pulls, window raisers, etc., are in oxidized silver and blue enamel. The lighting is by corner lights in blue and silver, in a Greek design.

The enclosed job is by Rubay on a Marmon chassis, and is named after the general manager of the Nordyke and Marmon Co., who ordered the original, the Moscovics type. This has natural wood interior, with individual chairs, which are adjustable and reclining. It is a three-door job, two doors on the right side and one door on the driver's side, with a large rear quarter window, which gives an unobstructed view for the occupants of rear seat.

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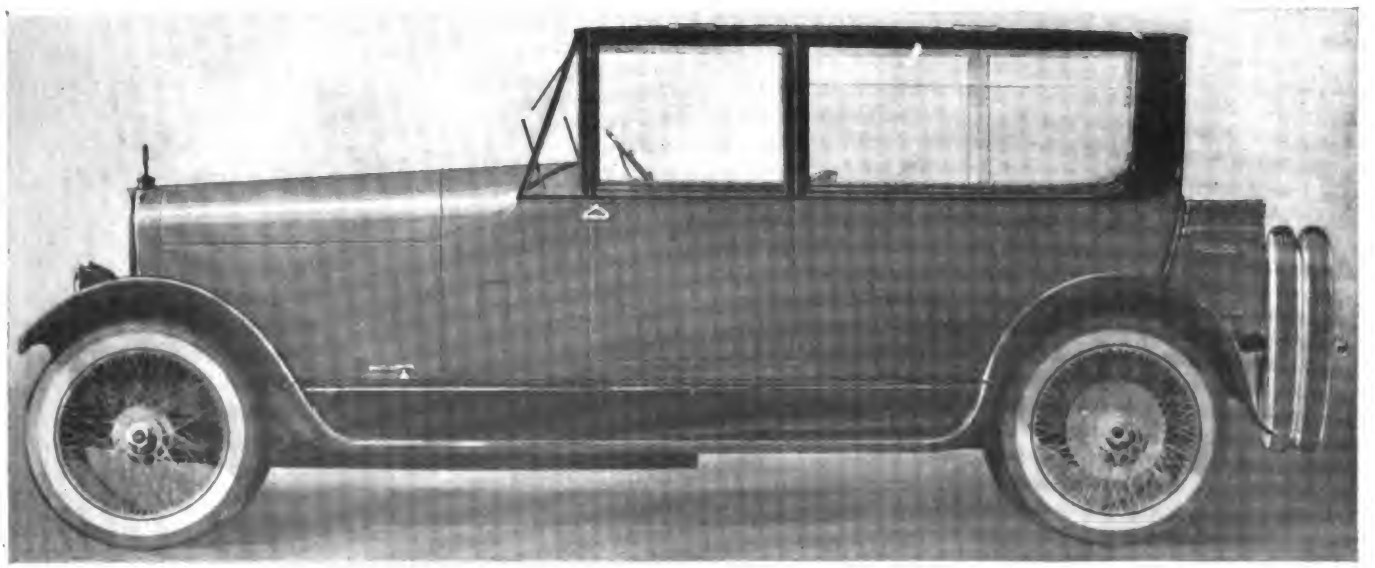
Examples of the Best American Coach Work

FOUR-PASSENGER COUPE

Special straight-line model built by custom body dept. Locomobile Co. of America, Bridgeport, Conn.



FOUR-PASSENGER SEDAN

Special body built by The Rubay Co., Cleveland, O.
Mounted on Marmon new series chassis

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Simple and Inexpensive Bus Body for Ford Chassis

The Ford car is used so widely, not alone in this country but all over the world, that it is not strange hotel men have found it very useful and economical. Aside from the so-called suburban type of body on the Ford with which baggage as well as passengers can be carried from the station to the hotel or vice versa, the bus body has found the largest use in this connection. Not only can the bus type carry more people, but it is more easily constructed. This in turn makes it cheaper, so its wide adoption by hotels, both large and small, boarding houses and similar places it not to be wondered at.

Large numbers of such a body could be seen all over last summer and the practicability of them was shown to such an extent that even the old timers are convinced that they are becoming a necessity.

They are quite easy to make and will probably be more in demand next summer than ever before, because they fill a need that has existed for a long time in rural communities.

The old way of hitching up a team and spending from three to four hours going to the station for the folks, then getting their trunks and baggage on another trip, whenever it could be done, is way out of date. And when a party of them wants to take a trip to the lake, say, or some other point of interest 10 or 15 miles away, they don't want to spend all their time getting there and back.

There is no reason why the village blacksmith cannot make a small body for a Ford chassis with advantage both to his neighbors and to himself.

This is the time to do it, when you are not overburdened with spring business and have the time. Talk with the hotel and boarding house people; show them your plans for a handy body that will make money for them, and tell them how much it will cost.

There are similar types made for the purpose by body manufacturers; but that is in your favor, as it invites comparison between those bodies turned out hurriedly in large quantities, and your work. Your neighbors and friends know what kind of work you can do and they would rather pay you the same amount, or more, for a well made body.

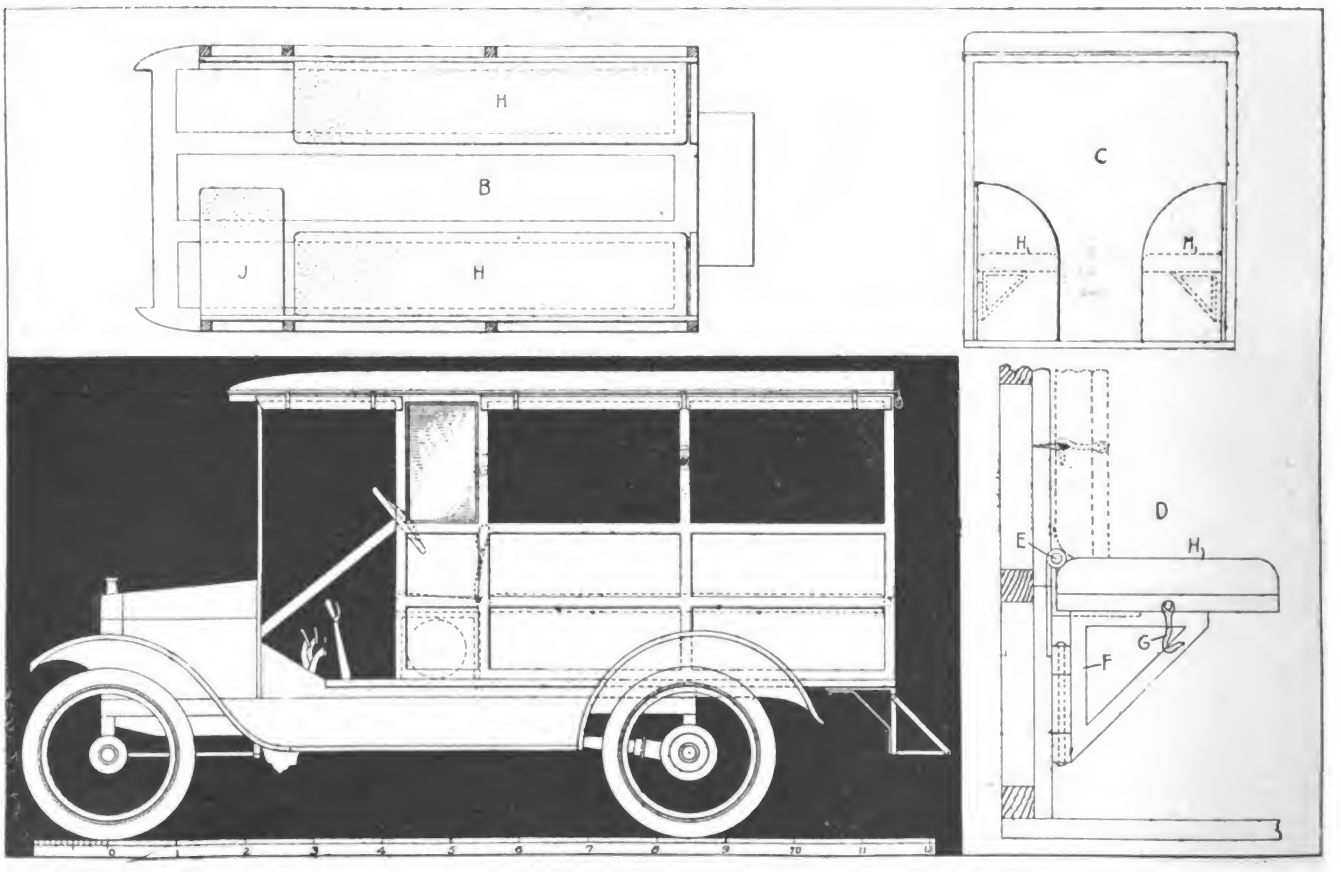
Plans are printed below for a body to be mounted on the regular Ford chassis, especially designed for the smaller hotels and boarding houses. It can also be used, if desired, for bus work.

The side view is shown at A, the plan view at B, the rear view at C, the seat construction at D, the hinges at E, the swinging bracket at F; and G, H and J are the hook, passengers' seat and driver's seat, respectively.

This body will seat eight people in addition to the driver, with room beside the driver and under the seats for suit cases, bags and packages. The seats are so arranged that they can be swung up out of the way and fastened, leaving the whole interior available on the next trip for trunks and large boxes. You wouldn't have to explain the handiness of this arrangement; it will be selfevident.

The body measures 7 ft. 3 in. long by 4 ft. 3 in. wide and 4 ft. 7 in. high. Each side of the body consists of four uprights, four feet of 2 x 2 stock; three front crossbars.

(Concluded on page 34)



Working drawings of bus body to fit Ford chassis, and which can be built by any carriage or wagon builder at a very low price

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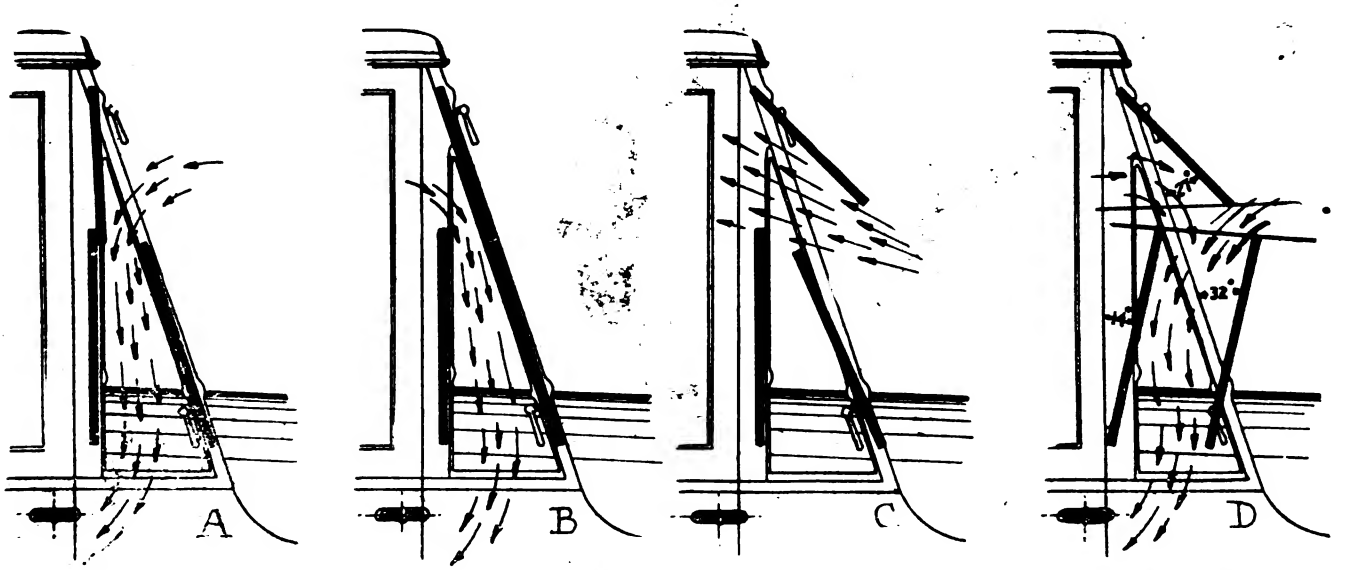
New Storm-Proof Windshield Has Many Advantages

With the growing tendency toward the year-round use of the closed car, the windshield assumes a greater and greater importance, for it is the windshield which keeps the enclosed body cool in summer or warm in winter, as the case may be. And the fact that the enclosed body can be cool in summer and warm in winter is what is making it so popular for all-year use. From this it can be seen that the windshield has a tremendous influence.

An entirely new form, known as the vacuum storm-proof shield has been brought out by the Cole Motor Car Co., and is being applied to the enclosed cars turned out by that concern. As shown in the sketch below, it has four adjustments, each of which serves a different but equally necessary and valuable purpose. The four adjustments are: That shown at A and called the ordinary cold weather position; that shown at B, called the mild weather adjustment; that indicated at C for warm weather, and that seen at D which is for rain or snow.



Sketches showing the construction and operation of the new Cole all-year-round windshield for enclosed bodies

Adjustment for Cold Weather

As shown in the accompanying drawing, when both sections of the glass in the rear division of the shield are closed in an upright position and the lower glass section of the outer shield is placed in alignment with the two supporting standards, an adjustment is secured which insures comfort within the car for ordinary cold weather driving.

Adjustment for Mild Weather

For ordinary driving, the lower section of the inner shield is maintained in an upright position, while the upper section is brought in alignment with the two standards of the outer shield. The lower section of the outer shield retains the position as in adjustment A. When adjusted in this manner a circulation of air is secured from both sides which travels, as the arrows in the sketch indicate, in between the outer and inner shield into the car through the open space above the lower section of the inner shield.

Adjustment for Warm Weather

In its third adjustment, which is that recommended for warm weather, the lower section of the inner shield remains stationary in an upright position, but both the upper section of the inner shield and the lower section of the outer shield are tilted as indicated in the sketch drawing labeled C, thus allowing a free passage of air into the car through the aperture between the upper section of the inner shield and the lower section of the outer shield and into the opening above the lower section of the inner shield.

Adjustment for Rain or Snow

The fourth adjustment, shown in drawing D, is that for stormy weather—either rain or snow. In this case the lower section of the inner shield is tilted forward at an angle of about 14 degrees. The upper section of the inner shield is tilted outward at about an angle of 27 degrees—the same as it is in the hot weather adjustment. The lower section of the outer shield is tilted forward at the top until the upper edge of its glass extends beyond the lower edge of the glass in the upper section of the inner shield, assuming a position at an angle of about 32 degrees to the outer shield supporting standards and practically parallel to the lower section of the inner shield.

When in this adjustment the air is sucked out from within the car while the rain or snow is carried over the top of the lower section of the outer shield and out the sides between the two shields. In addition, a clear vision space unobstructed by any glass exists between the lower edge of the upper section of the inner shield and the upper edge of the lower section of the outer shield through which the driver may view the road plainly regardless of the severity of the weather.

The possibilities of the vacuum storm-proof windshield are so effective and when properly adjusted it has so many advantages over any other windshield so far developed that every owner of cars possessing this advanced feature should be thoroughly informed regarding it so that he may enjoy it to the utmost.

Production of iron and steel in Britain for 1919 totalled 7,370,000 tons of pig iron and 7,880,000 tons of steel ingots. The iron figures are the smallest in 20 years.

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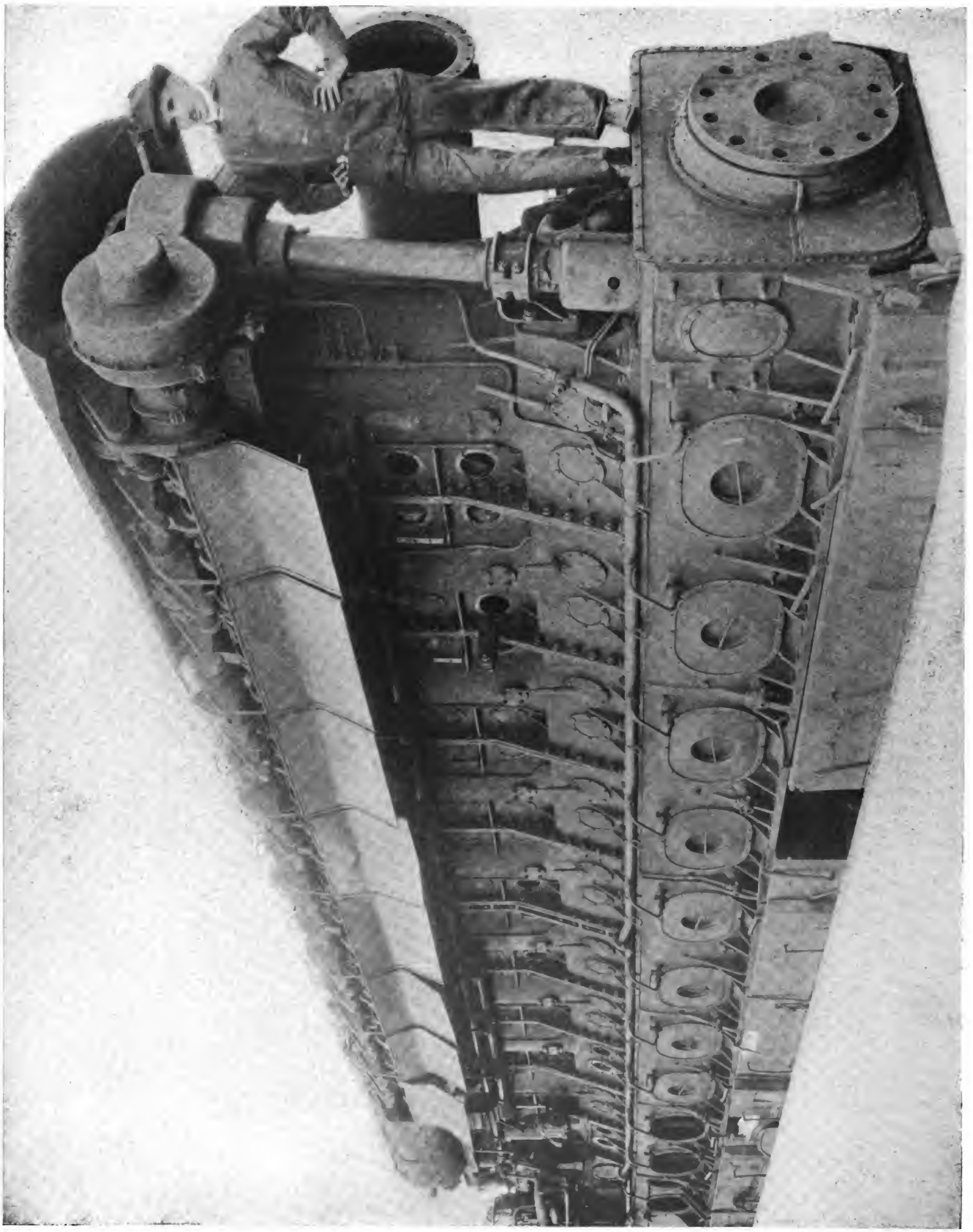

Fig. 1. Front side of the 3,000 brake horsepower (4,000 h.p., Indicated) Augsburg four cycle, single acting reversible submarine Diesel engine built by Maschinenfabrik Augsburg-Nurnburg, Augsburg, Germany. The man standing beside the vertical forward shaft gives an idea of its size

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World's Highest-Powered Naval-Type Diesel Engine*

Details of the Augsburg Ten-Cylinder 3,000 Horsepower Heavy-Oil Unit Used in German Submarine Cruisers—Lauster Design Noted for Conservative Ideas and Reliability

THOSE who have followed the progress of the Diesel type of engine in recent years know how rapidly it has progressed and how much more rapidly it is going to progress in coming years, so to them nothing that happens is surprising. To the average automotive man, however, and even to many engineers, it will be surprising news that a Sulzer engine of 4,000 brake horsepower is under construction for Japan, while engines have been designed in several shops which will have a power output of 1,000 horsepower per cylinder. Until these are available, however, the record of the world for maximum output is held by the Augsburg product, which develops 3,000 brake horsepower.

These engines, pictured herewith and described in detail subsequently, are constructed at the Augsburg works of the Maschinenfabrik Augsburg-Nurnburg, where the late Dr. Rudolf Diesel did most of his work. The chief engineer of this plant, Herr Imanuel Lauster, was closely associated with Diesel. This design of his in which no departures from conservative practice will be found, is generally admitted to be one of sound design, fine workmanship and reliability.

This much credit we wish to give our late enemies, the engine as we saw it in Europe on several recent occasions, is a splendid job. The following is the first technical description available of this latest of war-time Diesel engine developments.

After the many reports of exceptional mechanical excel-

*Published by special editorial arrangement with Motorship, the editor of which personally secured this material on his recent trip to Europe.

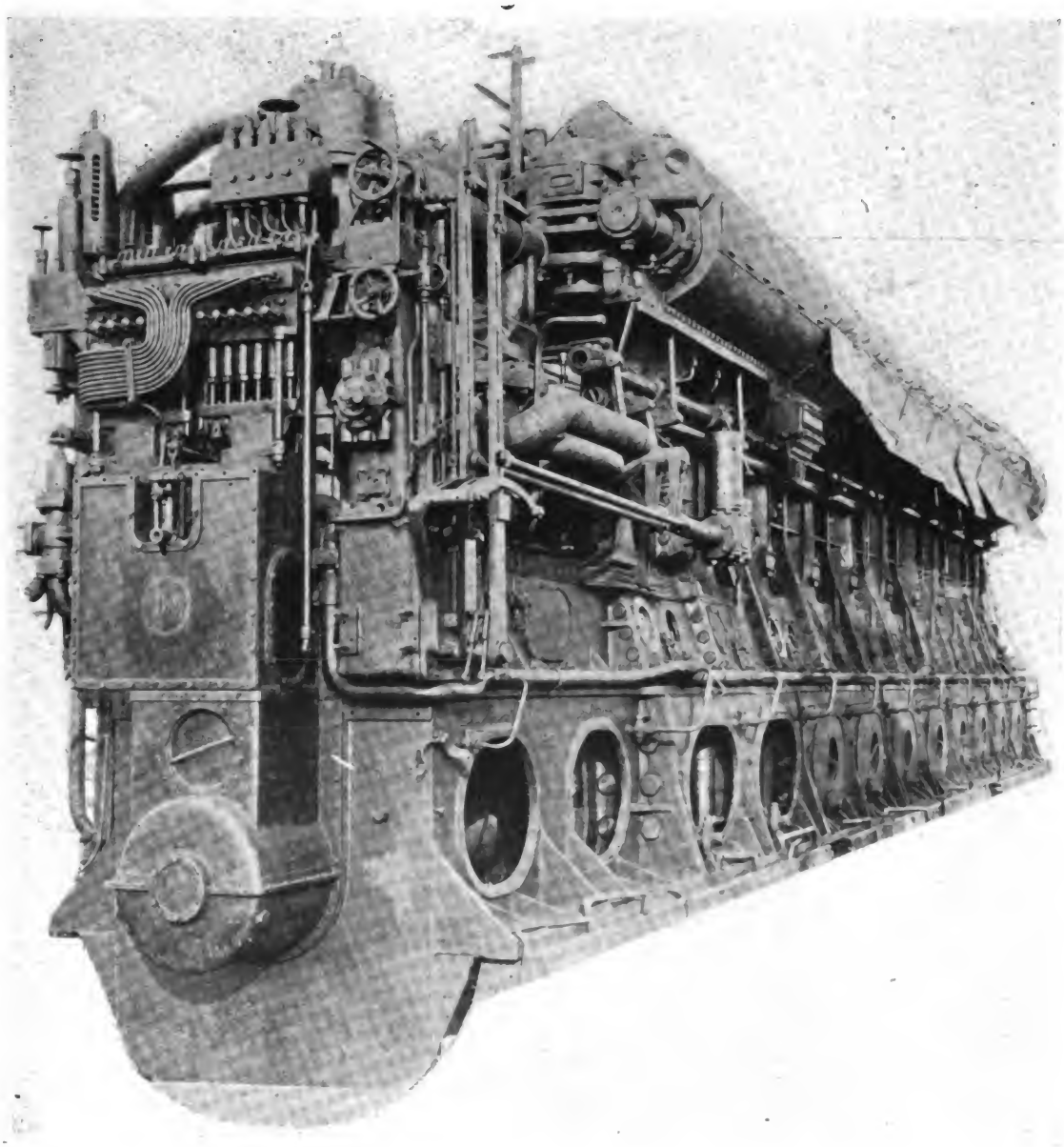

Fig. 2—Forward end of the Augsburg engine, showing the fuel pumps also the grouping of the control mechanism. The long starting levers each control a group of five cylinders

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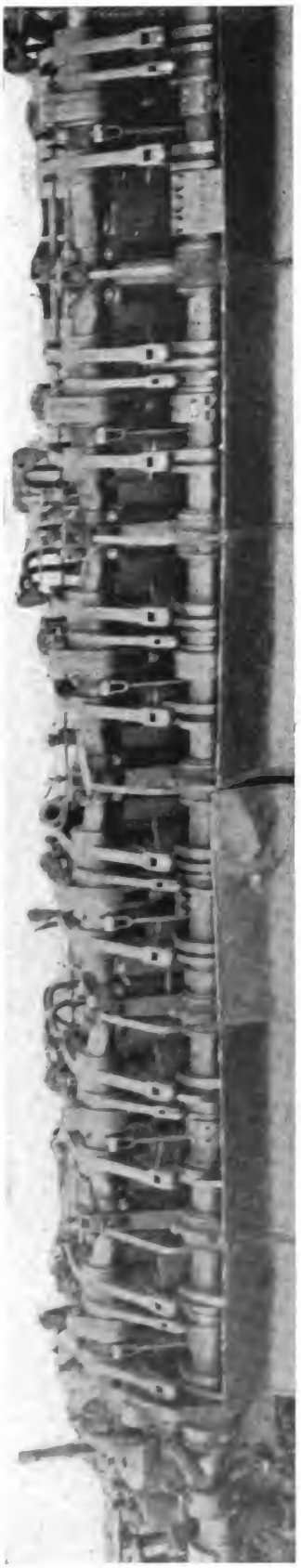

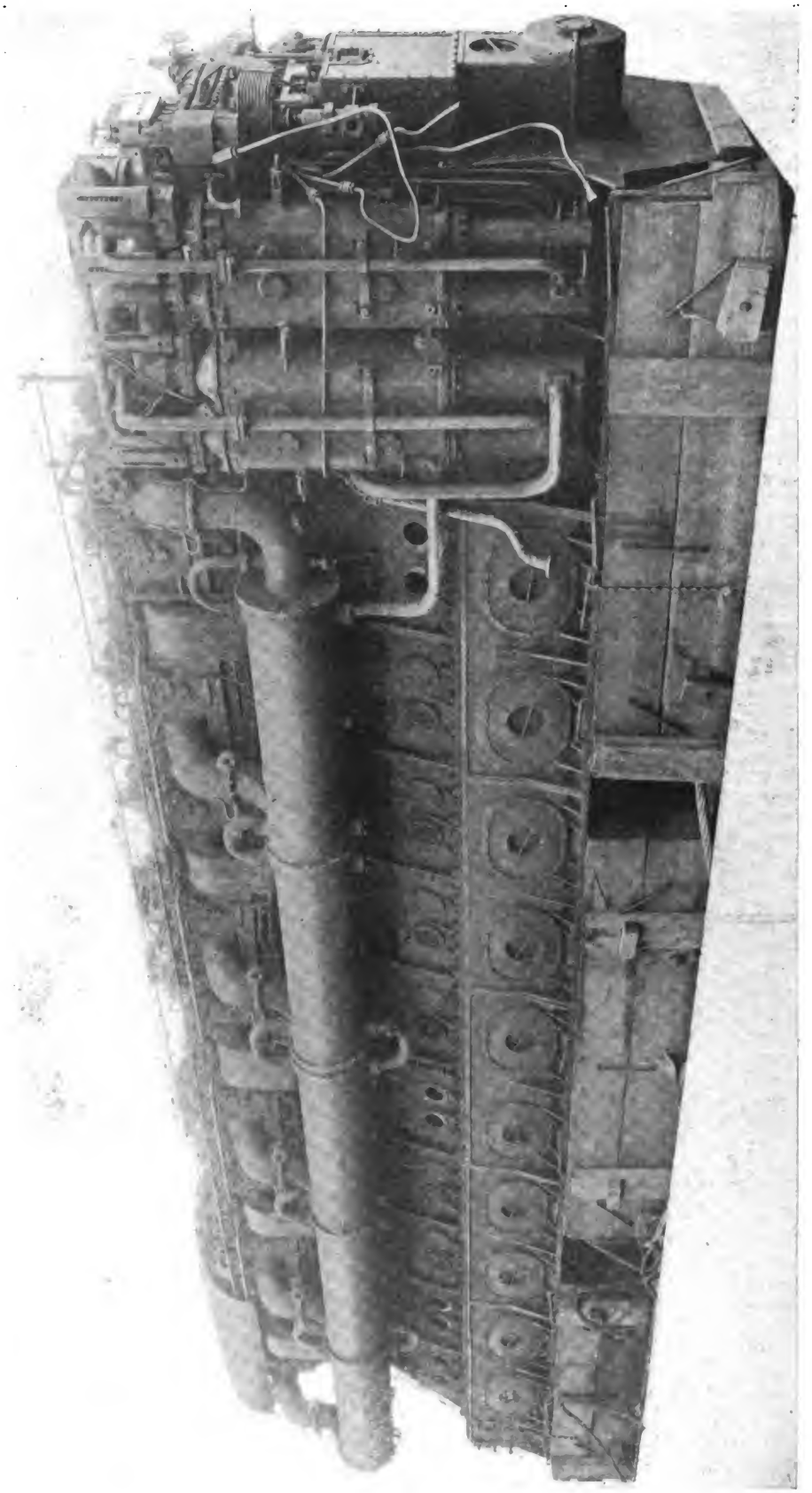

Fig. 3—Back view of the big Augsburg Diesel engine, showing exhaust header with sections for each two cylinders, also at right, intercoolers in air compressing system

Fig. 4—Above, the camshaft viewed from above. This, in conjunction with Fig. 1, gives a good idea of the cam and cam lever arrangements

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lence and service reliability which have been current throughout the world concerning the Diesel engine development in Germany during the war, it was with avidity that we inspected the engine. As careful and thorough examination as possible was made as far as the outward appearance goes, as no authority was secured to dismantle any part.

To say that we noticed many innovations from usual practice is putting it mildly. They impressed us both favorably and otherwise, but in all cases a ready explanation was obvious and considering either the limitations of service, the emergency or lack of proper materials every detail was carefully and successfully worked out to produce a remarkably compact, light, accessible, and, as we know, reliable engine.

These said characteristics seem to have dominated the minds of the designers. A "minimum of excess strength" hence light weight—is continually in evidence and the low overall height was undoubtedly made imperative by the low headroom available in the submarines. Other limitations with which the designers had to cope were the lack of any copper or brass for piping, valves, stuffing boxes, unions, etc. The only brass or copper of any account found at all was the tubes of the air compressor intercoolers and, of course, the bearing metals. All intake ducts were a white-metal alloy with the appearance of aluminum. So under the circumstances the production of such a high-powered engine is a remarkable piece of engineering.

In a general way we can mention the larger parts of interest which are noticed upon first walking around the engine. It can be seen that the engine shown is the starboard unit of a twin-screw installation and is a 10-cylinder four-cycle reversible high-speed engine reported to be designed to run at 385 r.p.m. When in England the bore and stroke was given us as being approximately 21 x 21 in. respectively, but so far as can be determined by measuring the assembled parts, the bore and stroke is 20⅞ x 20⅞ in.

The following are the main dimensions of the engine:

Length overall	37 ft. 5 in.
Height (bottom bedplate to top valve rockers)	11 ft. 6 in.
Width	5 ft.
Bore and stroke	20⅞ x 20⅞ in.
Weight	75 tons
Number of cylinders	10
Power (shaft)	3,000 b.h.p.
Power (indicated)	4,000 i.h.p. (about)
Engine speed	375 r.p.m.

Regarding the large submarines in which some of these powerful engines were installed, they are as follows:

Displacement (submerged)	2,785 tons
Displacement (surface)	2,158 tons
Power (surface)	6,000 b.h.p.
Power (submerged)	2,600 b.h.p
Length	320 ft.
Breadth	31 ft. 6 in.
Depth	17 ft. 6 in.
Speed (surface)	18 knots
Speed (submerged)	8.1 knots
Bunker capacity	451 tons
Cruising radius (low speed)	20,000 nautical miles
Complement	83 men

Control of the main engines is at the forward inboard end, and is concentrated in the two vertical levers and the lower of the two small handwheels. The upper handwheel is for regulating the first-stage suction of the air compressors. There are two single-crank two-stage compressors at this end on an extension to the main shaft with a bearing at the outer end only. All fuel pumps, one for each cylinder, are driven off a common crosshead, the casing of this pump drive being shown in the foreground of one of the illustrations. All the fuel lines, in fact, every bit of piping on the engine is steel tubing with welded flanges—even the connections where cone joints are used are steel.

Moving around to the port side—for further casual inspection we see the separate intercoolers for the two compressors, the five-piece lower crankcase and bedplate and the ten box-type cylinder castings with two handholes in each. It will be noticed that one is fitted with a blank cover and the other with a screen. Over this screen is a complete, or partially so, paper gasket. It is as though the latter were meant for breathing holes and were later covered with paper to keep in the oil.

Remarkable Welded Steel Exhaust Header

Most remarkable in this view is the 17 in. inside diameter welded steel exhaust header. This is shown in five pieces with a distance piece between cylinders 5 and 6 to correspond with that between the cylinder castings at this point. This header is of sheet steel with a longitudinal welded seam. The cooling-water space, tinned on the outside of the inner pipe and on the inside of the outer jacket, is hardly a good ¼ in. in thickness. Welding is also used for the connection of this jacket wall to the end flanges. When it is mentioned that these sheet-steel tubes appear to be about ⅛ in. thick; that the header flanges are about 20 in. in diameter and only ⅝ in. thick connected with 16 7/16 in. diameter bolts, an idea is gained of the scant margin of strength and the extremes to which the designers went to keep down the weights. All the pads for the cooling-water by-pass bends are welded on.

Superlatives might well be used on this subject when attention is drawn to the seven part butt-welded elbows and Y bends connecting the several pairs of cylinders to the exhaust header. Similarly the inlet ducts of some aluminum alloy are welded along the corner seams. These suction pipes lead to a large flat plate that is well slotted, and which is mounted opposite the space between the cylinders formed by the box-shaped sides of the cylinder castings.

Leaving several piping details until later we proceed to the inboard side of the engine. This is as usual the camshaft side and the general arrangement of the inclined upright drive shaft is quickly noted. This scheme results in keeping the overall breadth of the engine within that at the bed plate, which, by the way, is only 54 in. from c. l. to c. l. of the holding down bolts. Helical teeth are used in the gears for the camshaft drive and a continuous bath of oil is assured for both upper and lower gears.

As mentioned before, the separate pieces of the crankcase extend for two cylinders, or from center to center of alternate main bearings—this distance being 68½ in. The height of these castings from the top of the crankcase to the underside of the holding down flange is 27¼ in. From this space to the bottom of the crank pit is 19 in.

Thin Steel Crankcase Castings

These crankcase castings are in a way the outstanding feature of the engine. Generally speaking—there is no part thicker than 1¾ in. at the most—all main stiffening webs are from ½ to ¾ in. thick and there are few flat

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surfaces more than 8 in. across that have not a lightening hole in them. And they are of cast steel. We doubt if such patterns could be cast in this country without extensive study and experiment for the shrinkage strains on cooling with the best grades of cast steel must surely be quite indeterminate, but undoubtedly severe. The metal probably is the so-called "electric steel" in which the ingredients are positively known and the composition and structure of the resultant steel is under positive control and of absolute uniformity.

Returning to the contemplation of the view of the crankcase, we see the forced lubricating-oil piping moving along its upper edge of the crankcase with branches leading to each main bearing. For these, holes are evidently drilled in the journals and through crank webs and pins so that the wristpin gets forced lubrication also. Between each lead of ¾ in. pipe to the main bearings may be seen a small ⅛ in. pipe leading over the large main pipe into the upper crankcase. Each pipe branches into two leads after rising to about the height of the lower pairs of hand holes and they completely encircle the cylinder wall. There are four points of lubrication—they being at the quarter points around the cylinder and not over the line of the shaft nor 90 in. away from it. Having both branches joined on the far sides eliminates the possibility of any or all of points of lubrication being blocked off due to any clogging between any two points around the cylinder.

Mounted on cylinder No. 1 (after end) are plug cocks for intermittent filling of various oil wells and also continuous pressure lubrication for various parts of the camshaft drive that require it. The after hand hole in each cylinder casting—just above the lubricating-oil pipe—is fitted with a plate carrying a guide for a hooked rod for the indicator gear. It is connected by a small line to the swinging rods of the piston oil-cooling system to be described presently.

The Oil Cooling System for Pistons

Passing on toward the forward end we notice the mechanism for air starting and fuel injection control. Before describing this, however, attention is called to the plug-cock connections along the base between the crankcase manholes. These are for the piston oil-cooling system—one for inlet to stationary cast iron receiver visible just inside the manholes in each crankcase and the other for the outlet. From the upper end of these cast iron receivers a 1½ in. pipe rises about 4 in. and ends in a swivel joint forming the first point of the swinging pipe which is connected by a hollow link to a socket attached on the inside of the piston. From the latter a ¾ in. pipe leads up to the cylinder head The outlet is arranged similarly on the other side of the connecting rod. About 2½ in. from the pivot or outer end of the swinging rod is attached the lower end of a small link rod about 8 in. long which operates the indicator gear mentioned above.

Taking off a few crankcase plates we were struck with several important features in quick succession. The apparently heavy crankshaft and lower end connections—the neat manner of lightening the connecting rod, which naturally contributed toward compactness and lower inertia stresses, and the large but comparatively light main bearing caps.

All the points mentioned may be readily noted. Close scrutiny will disclose the I-beam or section adapted to the main bearing cap. This cap is about 21 in. wide, 20 in. deep over the bedplate, and 12½ in. long. It was not possible to determine the diameter of the main bearing journal or that of the lower end bearing, but they were approximately 13 in. in diameter. Between the inner cheeks of the crankwebs the distance measured 12⅝ in., giving an effective bearing surface on the crankpin of 10⅞ in. Locknuts with cotter pins were used on the lower ends of the connecting rod bearing bolts.

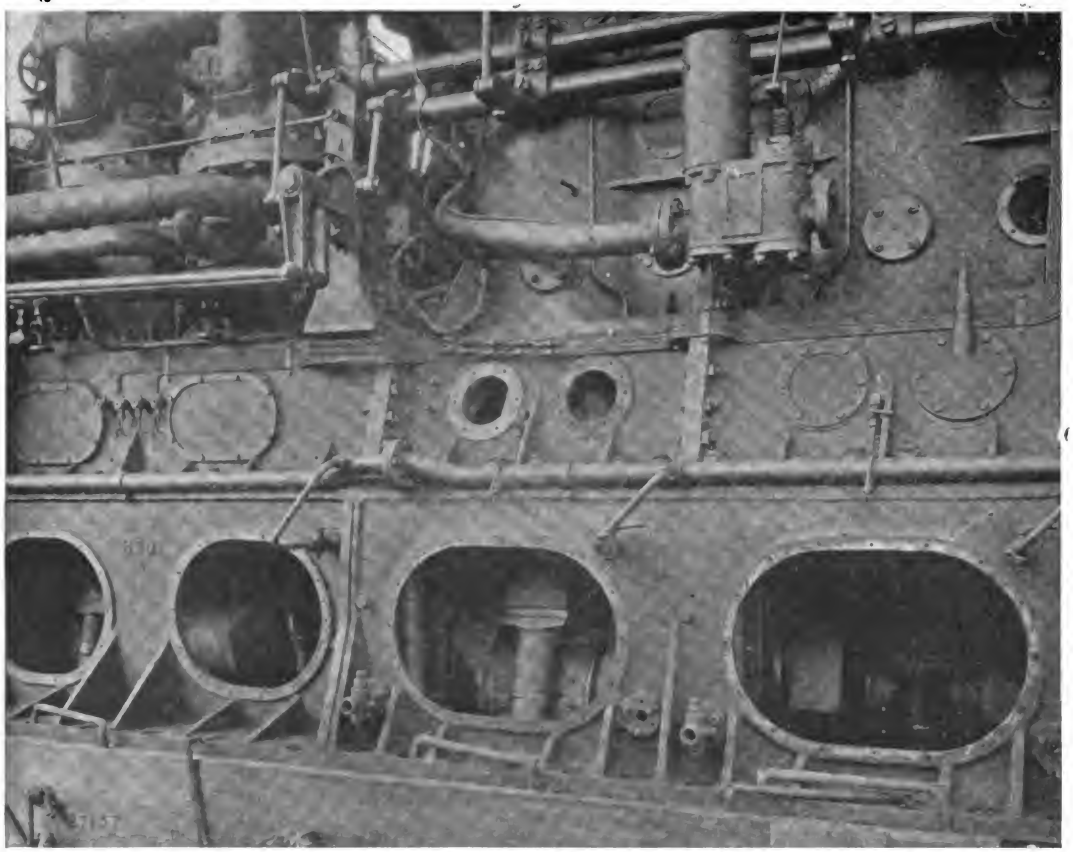

Fig. 5—Closer view of maneuvering gear, air compressors (at upper left), connecting rod caps and crankshaft of the Augsburg engine. Note how the rod weight is kept remarkably low by eliminating excess metal

Some Crankshaft and Bearing Details

The crankwebs are 14 in. wide and 5 in. thick. Owing to the lack of time owing to the increasing darkness we were unable to satisfy ourselves as to how the crankshaft is built up or coupled in the center between cylinders 5 and 6, but are of the opinion that the central journal is fitted with solid

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flanges turned at each end similar in size to that shown at the after end view, and the crankweb increased in width and countersunk to allow cheese headed-reamed coupling bolts to set in flush with the inner face of the crankwebs. The very small increase in the distance between these two cylinders (only 4 in.) even suggests that the whole ten throws of the crankshaft were built up.

It may be noticed that all the bolts joining separate parts of the crankcase and bedplate are placed inside, there being a total of 22 bolts in each joint. All are fitted with a cotter pin, and the coarse thread used seems to be adhered to throughout all such parts on the engine and all are provided with a deeply milled spot face sometimes about ¼ in. deep.

Upon beginning to examine the moving parts mounted on the engine we immediately saw the smallness and almost frailness of the various links, rods and levers rendered necessary by weight restrictions. Perhaps the most interesting of all the mechanisms employed is that for lifting the valve rockers and shifting the camshaft. By referring to the illustrations, this can be seen at the forward end of the shaft. In line and to the right of the upper end of the outer control lever will be seen a gear casing on which is mounted a little window. Within this casing is a spur gear mounted on a vertical shaft and meshing with a toothed rack for which the casing can be seen extending to the right above and beyond the end of the camshaft. This rack is an extension of a pneumatic ram which operates in the same line across the engine.

On the vertical shaft, on which the horizontal gear are mounted are arranged cams and slotted discs. Above is a bevel-gear meshing with another mounted on the shaft carrying the valve rockers. By mounting these rockers eccentrically on this shaft, movement of the reversing piston rotates the shaft and raises the rockers off their cams. Fore and aft movement of the camshaft is obtained, after the rollers have been lifted by the action of the aforementioned cams on the levers or palls visible under the little window on the gear casing. Mounted on this gear is a dial, which is visible through the window to the operator, who can tell at any moment the actual position of the maneuvering gear. Thus, if after the operation of changing the direction of rotation is commenced, and the gear should jam for any cause, the operator will know without examining it just how far the maneuvering had proceeded and perhaps in this way where to look for trouble. In one of the illustrations the short link connecting the crank in the near end of the upper shaft is locked by the flat disc shown fitting into a slot in the small rocker arm. When the camshaft is shifted and rocker arm rollers have been lowered a notch in the disc registers with the slotted finger, and the air valve rockers may then be brought down on their cams for starting. We were able to see that the inner control lever operates the starting air for the forward five cylinders through the shorter and lower of the two shafts and that the outer lever turns the long shaft through a similar pair of bevel gears to control air to the after five cylinders. A small line is operated by this latter shaft to open and close the valve on the starting air line—this valve being very prominent in one of the illustrations.

Attention is called to the following features which are self explanatory. The suction for the air compressor first stages is shown neatly combined into one muffler. The little handwheel visible beyond is geared to a revolving sleeve giving control of the first stage suction. All discharge pipes from each stage are covered with the screening as shown. Note the oil lines to the working parts of the air compressors. There is a gang oiler for this system.

A few remarks on the fuel-pump may help to understand the manner of control. The small hand-wheel on the level with the pump-body controls the amount of fuel pumped by means of levers and links provided with interlocking devices not shown and partly dismantled which it will be unnecessary to describe. This control finally terminates in the link and bell crank mounted on the center line of the engine below the pump plungers. The vertical link goes down inside the casing to a loose eccentric which drives the single crosshead through a long connecting rod. This crosshead drives the two plunger rods to which are connected the two groups of five fuel valves. Hand priming is performed by working the flanges shown entering the forward side of the pump body. Above the line of discharge pipes may be seen a shaft carrying ten little tappets and a short crankarm at the right and from which hangs a long link. This is the control of the suction to each pump and it is difficult to say just how it is connected up.

The loose eccentric mounted on the extension of the air compressor cranks varies the amount of eccentricity, hence the stroke of the pump plungers. There is also a centrifugal control on the same shaft which will act automatically at overfeeds.

Following the fuel lines around and along the engine we see that each line enters a small bypass valve from which a pipe runs to a common return pipe, which can be seen as the bottom pipe of the fuel lines and it is this pipe which may be seen turning downward from the bank of ten tubes from the fuel pumps. From each pressure relief bypass or overflow check valve mounted on each cylinder two wall pipes enter the double fuel valve body.

A noteworthy feature of this engine is that it uses two injection valves simultaneously—these valves opening outward and operated by the single rocker arm are about 8 in. apart. The bottom of the cylinder head is quite flat and the piston head very slightly disked. It was not discerned by what method the designers insured equal quantities being pumped to both valves, although each fuel pump works twice to every injection into that cylinder.

A few additional remarks on the arrangement and details of the cylinder head mechanism will finish the description of the mechanical features of this engine. All piping, both for water, fuel, air starting, exhaust and inlet, is arranged to serve the cylinders in pairs. This is illustrated by the alternate arrangement of exhaust and inlet valve pipes. Both the exhaust valve cages and the valves themselves have separate cooling water circulation. In the case of the valves the connections may be discerned in one of them and are of flexible hose encased in a braded cord covering. The cylinder heads are octagonal in shape and a cylinder head holding down stud is located at each corner, making eight per cover.

These studs are very short, extending only about 3½ in. above the cylinder liner joint and the bolt is elongated to resemble a hollow pin—threaded inside—at one end to match the stud and with a narrow shoulder about 2½ in. below the upper end on the outside. This shoulder takes the combustion pressures to each stud. These nuts when set up do not project above the cylinder head—they being

(Concluded on page 34)

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New and Improved Ideas in Body Finishing

How and When to Use Wire Brushes

The utility of wire brushes in connection with various operations of painters' work is by no means so well understood as it should be. If carefully selected as to shape and degree of stiffness they may be used to effect a great saving of time in rubbing down. In repainting iron it is, of course, very essential to remove all the old paint as well as rust, scale, etc. If this is not done, and done thoroughly, it is simply a waste of time and material to proceed at all, because the rust will continue to spread underneath the paint.

Rust and scale may require for their removal repeated hammering or knocking in some form, and where the extent of the work warrants it a specially constructed hammer worked by electricity will be found very effective. Scrapers and steel-wire brushes will follow, and they will be found to be remarkably effective in speedily producing a clean and level surface suitable for repainting. These brushes are made in various forms. If properly cared for they last a very long time. The simplest pattern is about 7x2 in., oblong in form with six rows of sharp steel wires which cut through the paint, etc., in a very short time. Another shape is rather longer and is convex in the form of the wires. This is used for removing varnish or wax before refinishing. Still another shape is employed for corners, ornamental work, moldings, etc., and may be described as a large toothbrush in shape. There is just one more pattern necessary to complete the kit of these very useful tools and that is a wire brush similar in appearance to a flat varnish brush having fine wires about 2½ in. long. This is the ideal tool for applying paint and varnish removers.

One of the important uses to which stiff wire brushes may be put is that of rubbing down to a level surface old painted work. They do their work far quicker than glass-paper or pumice stone.

In this connection two other specialties may be mentioned, namely, steel wool and steel shavings. The former is made in four grades of fineness, and after a little practice will be found to cut down much quicker than ordinary glass-paper.

Steel shavings do all that steel wool does, but they are only fitted for the rougher kind of work.—A. S. Jennings, in Building World.

Advantages of Striping Pencils

Formerly very few painters cared to use the bought ready-to-use striping pencils. Such pencils had too much of the machine-made qualities, and they were seldom satisfactory. The expert stripers in the big factory shops made their own pencils, and scorned the idea of using a brush factory-made pencil. Within the last 15 years, however, this prejudice has been largely overcome. First class striping pencils, of both the sword and dagger type, are now to be had from almost any of the leading brush manufacturers. With these pencils some of the finest sort of fine-line striping is being done. In fact at no time in the past has it been surpassed.

The camels' hair striping pencil can best be made of swan-quill round pencils. In buying, the pencils had best be procured in hair line, fine line, stout line and round line sizes. Some exceptionally skillful workmen find it possible to execute practically all of these various lines with the one pencil, but our advice is procure a pencil for each size line. Such pencils will prove easier to use, and with them in the hands of a moderately skilled workman better results will be accomplished.

Much depends upon the care bestowed upon the pencils. Clean them out thoroughly after use in turpentine and then rub the handles rapidly between the palms to dry out the stock. Then grease carefully with equal parts of mutton and beef tallow and lay the pencils away in a dirt-proof container. Good, free-working pencils may thus be maintained all the time.

Differences Between Painting and Varnishing

What are the essential differences that should govern the application of paint and varnish? Of late years they seem to have been quite overlooked. Your modern painter too frequently just puts it on—gives it a coat.

Some of the painting that I have seen go wrong, blister and crack and rizzle up, is so absolutely bad in theory and practice that I am impelled to talk of such an elementary point.

Give it a coat! Why, some of the coats I've seen have been great coats, overcoats, two coats in one—anything but a real coat of paint!

Painting is not simply laying on a spread of paint. Painting is the art of spreading the paint itself on a film of inappreciable thickness, evenly distributed and well rubbed in. Most modern workmen just smear it over, and never give a thought to the important point of "painting" it on at all.

Paint should be crossed and recrossed, rubbed in and smoothed off, till every particle of it is in close and intimate connection with its ground.

Let there be less paint and more brush work. Brush work is a good work; the paint requires working with the brush. It is quite possible to so lay on a coat of paint that half of the underside of the coat is not in actual contact with the ground on which it is laid. You can slur over from little hill to little hill in the work, so that the cloud of paint doesn't even touch the little valleys.

That is not painting as I understand it, and it is what is at the bottom of lots of the difficulties that correspondents write about.

Of course, there are exceptions to every rule. For instance, you don't want to rub out a coat of flatting in this way. Why? Because the turpentine color will find its own bed and bottom, and by its solvent action will attach itself firmly to the ground. But even in flatting you don't require to put on two coats at once.

The cure for most of the complaints I receive is more painting and less paint. A gallon of paint should be spread over double the superficial area that a gallon of varnish will cover.

Now let us consider varnishing.

Varnish wants laying on. The more you can put on without danger of running the better will be your surface.

You must have a surface that will take varnish without cissing or rubbing it on, and you must lay it evenly with

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as little friction or brushing as is consistent with evenly spreading it.

The reason for this is that the deeper the coat the more level will the surface be. The varnish should form its own surface over the surface of the paint. It should flow to a perfectly level surface. Any excess of working will froth it and form troublesome air pits and air holes.

Paint should stay exactly where it is put. Varnish should flow to a smoother surface of its own making than any brush will provide. That is why flat varnish brushes that lay it on quickly and evenly are best. That is why no paint brush is equal to a fine oval ground brush that will brush out the pigment to a fine, almost imperceptible film. After a proper painting there should be no possibility of ridges of paint or brushmarks.

I consider that, at a very moderate computation, the amount of excess paint used wastefully and wrongly is equal to the amount actually required; that is, every painter's shop sends out and puts on double as much paint as is necessary or desirable to produce the best results.—W. J. Pearce, in Decorators' and Painters' Magazine.

How Painters Can Keep Well

One of the ways in which all painters can keep well and healthy is to avoid lead poisoning. According to a circular issued by the Ohio State Board of Health, this can be accomplished as follows:

Lead does not get into the body through the skin. It gets in through the nose or mouth. Hence it should be easy to avoid lead poisoning.

Nineteen out of every 100 deaths among painters are due to consumption. Twice as many painters die of consumption as carpenters. Working with poisons causes the difference. Poisons predispose to consumption.

Eat a good breakfast before beginning work. A full stomach lessens the danger of lead poisoning.

Milk is the best antidote for lead. Drink it at lunch or during the day.

Do not put food or tobacco into your mouth with dirty fingers. In other words do not feed lead to yourself.

Rinse off lips before eating or drinking. Keep mustache short so as not to touch your food or drink. A mustache is a danger, since it collects dust.

Wash hands thoroughly with warm water and soap before eating whenever you can.

Eat your lunch outside of the room or place where painting or sanding is done.

Keep fingernails clean. Do not use them for toothpicks.

It is a good plan to rinse out your mouth before eating or drinking.

When sanding avoid breathing the dust or allowing it to settle on your lips.

While sanding do not chew tobacco or gum. The chewing movements always cause a little swallowing which you do not notice.

Do not moisten your lips with your tongue. Each time you lick in some lead particles which have settled on your lips.

When possible do sanding with a little mineral oil present to absorb the dust.

Brush your teeth at least in the morning and at night, the latter before going to bed.

Avoid alcoholic drinks—they make you more liable to lead poisoning.

Do not use a dirty cloth or rag to wipe off your face, nose or lips.

Have a good bowel movement each day—best time is just after breakfast. Make the habit regular.

Have overalls and jumpers washed at least once a week.

Painters should get a good bath at least once a week, and use plenty of soap.

Remember also that all dryers and paint removers are poisonous. Do not breathe their fumes or odors in a closed-up space. Have good ventilation.

Turpentine damages the kidneys sooner or later.

Be examined by a doctor occasionally.

A Plea for Quiet Colors

All too many automobiles in the past have been painted in loud, gaudy colors, and even today, whenever a special body is created, the decision as to color of paint if left to the average painter is apt to be in favor of some wierd color or some "new" shade. The progressive painter should work in just the opposite direction, for these colors aside from hurting the artistic sensibilities, do not wear well, and the customer who has been overurged in this direction is very likely to remember it against the painter, as soon as he turns against the strong color personally.

There was a time when color selections were based in large part upon what "milady" chose to ordain as the reigning belle. These selections were often inappropriate, ill adapted to size and lines of surfaces, and not infrequently a horrible example of selective taste. Fortunately, however, the painters, who of all men should be best qualified to create harmonious and beautiful color effects, have succeeded in so influencing the opinion of the automobile using public that the result is that colors of more conservative patterns and quieter tones have become the favorites of fashion.

The contour and lines of the car must in the very nature of things indicate to the experienced painter the most appropriate and effective color for that particular type of car. All cars painted with a combination of two or three different colors should carry a selection in which each color materially assists to increase the good looks of its neighboring pigment while at the same time conferring upon the combination a relationship beneficial in all respects to the united pigments employed. In other words, there should be what in baseball parlance is termed "team work."

This article is not intended to detract from the merits of a color, or a combination of colors, in which the gayer effects are in evidence. Nevertheless, the desire is to point out to readers of this column engaged in automobile painting the importance of adhering to conservative color selections, such selections to be governed in large part by the individual style and size of the car. Meanwhile, the fact should be borne in mind that the preponderating trend of fashion is in the direction of dark, quiet colors, brought out in the largest measure of brilliancy possible, and cast upon a surface made smooth and level and as free from imperfections as the painter is capable of producing.

The Ranger oil field, which promised to be such a big producer, is now put down as a failure, many of the wells being practically nonproducers after less than a year. Oil men say too many wells in the district have drawn the oil from the pool.

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Vol. LXI FEBRUARY, 1920 No. 11

A New Idea in Car Construction and Sale

IN the statement of a well informed man on the subject of motor car production for 1920, a new thought is noted. It is that cars now are being made so much better, constructed to last so much longer, that the replacement business is not what it was, and is rapidly growing less each year, so that manufacturers in figuring their future construction plans must allow for a gradually decreasing amount of replacement business.

The idea is that better and more suitable materials are being used, design is better, assembling and testing methods are better, the bodies are built better and fit the chassis better, so that the car as a whole is better and more lasting than ever before. Under these circumstances and with the annual model habit forgotten, while the changes made from year to year are extremely small, detailed refinements rather than big basic changes in either construction or appearance as has been the case, a man buys a car not for a year as was the case, but for seven, eight or ten years as the case may be, or perhaps even longer.

Under these circumstances people can be expected to spend a little more for a car than previously, but should be expected to pick out the car with more care, taking more time to it. A greater return per dollar to the buyer is evident, but from the manufacturer's standpoint it means that the replacement business, formerly amounting to perhaps 40-50 per cent of the previous year's business, is now down to less than 14 per cent of last year's total, and will be still lower next year. It means that the manufacturer must reach out for a greater and greater new car sale each year in order to maintain any set figures for replacement business. And this increased reaching out for new and virgin business means that the car must constantly be improved, which is a very good thing for the industry.

Incidentally, this very well posted man, a prominent accessory and parts builder with his finger on the pulse of production all the time, says that a production of cars and trucks totalling three to three and a half millions would just satisfy the demand, but conditions will make such a huge total impossible, two and a quarter millions being the probable maximum.

Labor's Responsibilities

NOT so many years ago the oppressors of the common people, according to the popular idea of that day, were the huge business combinations. They were accused of doing everything under the sun, when their ultimate object was to increase production, lower costs, and in these ways increase their own profits. The net result of increased production and decreased costs of production per unit to the ultimate consumer was a lowered price regardless of whether the big consolidation made greater profits or not. Time has shown us this truth, and today there is no antagonism for the big combination, corporation or trust simply because it is big.

Labor today appears to wield power somewhat similar to what the big combinations were accused of, but it can scarcely be said that it is using this to any good purpose. On the contrary it is using this power to reduce production at a time when we need the greatest amount, and to increase costs.

While an eight-hour day and a living wage, as the popular slogan of the unions goes, is a good thing for all concerned, in its truest interpretation, it should mean an honest eight hours of work, and this fact must be driven home with organized labor. To demand a shorter day and higher wages means that labor must produce more than it has been producing and in less time. It is easily possible, if arbitrary restrictions are abolished upon the quantity of work a man may do in a given period. But if labor demands a shorter day, and then rules that the union man may do in that day only a fraction of the work he is capable of doing, it is creating a situation that must become impossible and will end in disaster.

Labor argues that by limiting the amount of work a man may do in a day it can multiply the job opportunities for workers. But that argument is only superficially true. It should be obvious that if 100 men produce only as much as 75 could produce, each of the 100 must get a smaller share than each of the 75 would be entitled to. But labor not only wants to use 100 men to do the work of 75; it wants also that each of the 100 should be paid as much as each of the 75 could earn. It cannot be done.

Increase production and the purchasing value of the dollar will increase with it. If this be not done sooner or later, we will run into trouble more serious than any we have yet seen. For a time the 5,000,000 organized workers of the United States who are pushing wages higher and higher may be able to sustain the high-price structure that is being reared simultaneously. But they cannot sustain it indefinitely. Presently, the decreased consumption of many millions more of unorganized workers is going to be felt, and the structure will collapse.

The largest exports from the Straights Settlements, of which Singapore is the principal port, consist of rubber to the United States and to the United Kingdom. In May, 1919, the U. S. took $271,410 and Britain $48,234, while in June the figures were $192,054 and $33,146 respectively.

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Simplicity Marks Design of Cato Monoplane and Engine

Many Novel Features Embodied in New One-Place Monoplane and Engine Give Slow Landing Speed, Quick Getaway and Ease of Handling

NOW that we are approaching the time when considerable pleasure and commercial flying will be done and are not far from the day when many persons will own and operate airplanes, it is interesting to note the features of new planes which make for ease of handling. More than this, the body builders and others most naturally interested in wood construction must begin to familiarize themselves with the more simple forms of aircraft construction. With this double thought in mind a detailed description is presented of one of the newer small planes

This single seater was designed by Joseph L. Cato, principally as a short plane, the objects in view being a very slow landing speed, quick getaway and ease of control together with inherent stability, good maneuverability and ease of handling on the ground. A wide chord was used to accomplish the performances desired. A special curve had to be laid out as none of the standard curves could be used with any degree of satisfaction. The new curve has been designed to obtain a good climb and slow landing speed rather than high speed. Recent tests have shown this curve to accomplish all it has been designed for, the climb being 4,600 ft. in ten minutes with the motor turning 1,350 r.p.m., a high speed 68-70 miles per hour, and a landing speed of 22-25 miles per hour. These actual performance figures with the following estimated performance figures, are correct aerodynamical principles.

Constructionally the entire machine is simple in construction, which in turn not only reduces the cost to the manufacturer and brings the selling price within reach of the average sportsman, but makes it stronger, better and more nearly foolproof. Simplicity has been the object of the designer and is by far the best and the shortest method to light weight which is so much to be desired in the small sport plane. The Cato sport plane has been designed with an average safety factor of 8.

This plane, on landing, can come to a dead stop within 45 ft. and get away within 50 ft. A man can run along with the plane and still keep up with it when the wheels start to leave the ground. The longest run made with the highest landing speed was 120 ft. to a dead stop against a six mile head wind. Mr. Cato has kept in mind that for a sport plane to be successful, it must possess the above features and be easy to fly so that any student can fly it with a few hours training.

The gasoline tank is located on the right wing and has a capacity of 12 gallons, sufficient fuel for about three hours. The oil tank is also located in the right wing. Oil and gasoline are supplied to the motor by gravity. To eliminate any chance of fire no gasoline or oil is carried in the fuselage. The fuselage is of monocoque construction of three layers of cedar, rather deep and quite roomy. The fuselage weight, as it comes off the mold is 58 pounds. It is not necessary for the pilot to sit on the floor of the fuselage in order to be protected from the wind. The seat is 16 in. from the bottom, and the top of the fuselage. just to the rear of the motor, is of such shape that the wind is deflected from the pilot, making a wind shield unnecessary and providing good vision.

The construction of the wings follows more or less standard practice. The wing spars are I section and the wing strut attachments are held on by four bolts clamping the spar through maple blocks. The wings are built in two halves and are supported by four main struts and three center section V struts. The main struts are interchangeable from right to left and from front to rear. The planes are located about 14 in. above the top of the fuselage. The wings have a backsweep of 5 deg. and a dihedral of 2 deg.; the incidence is 4 deg. The loading is 3.91 lbs. per sq. ft. The inner ends of the ailerons are set back at an angle of 4 deg. so that they will be more effective at very slow speeds. The ailerons are interchangeable from right to left. The stabilizer setting is fixed and cannot be changed in flight. The stabilizer is of the double camber type, in two halves, which are interchangeable. The elevators are also interchangeable from right to left and with the rudder. The fin is set a little to one side to overcome the propeller torque and relieve the pilot of holding the rudder over. All control cables to tail parts are interchangeable.

The tail skid consists of a three-leaf steel spring. The running gear is of V type built entirely of steel tubing The Vees are interchangeable from right to left. The axle is supported on rubber cord. Large wheels are used to provide easy rolling.

An unusually neat stick control is installed. The throttle control is attached to the right side of the fuselage. The rudder bar has three adjustments: short, medium and long. It is possible to step from the ground into the fuselage, as it is only 22 in. The entire machine is well streamlined, which gives it a very neat and pleasing appearance.

The engine was designed especially for the Cato sporting monoplane. In the design all experimental and untried features were eliminated and the extreme importance of interchangeability was kept in mind. Light weight was

Fig. 1—General appearance of the Cato sporting monoplane on the ground

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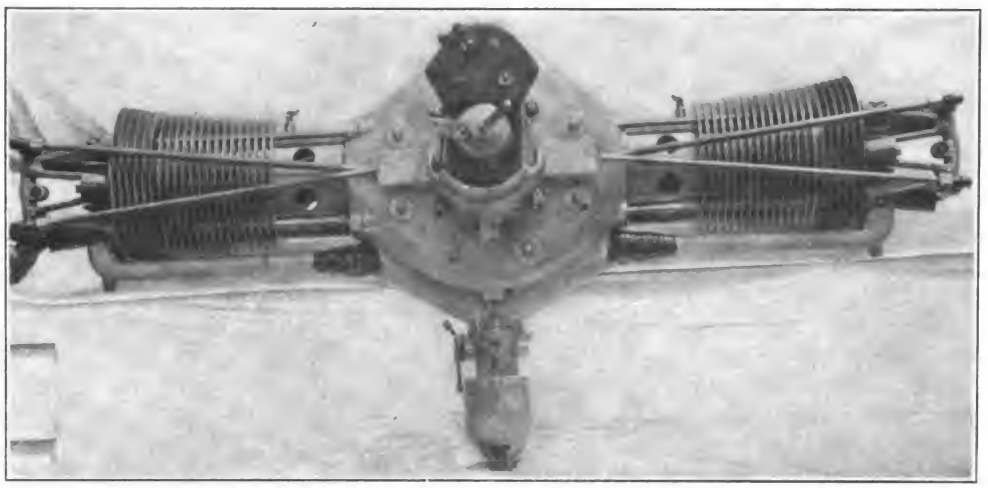

Fig. 2—Magneto end of the light two-cylinder opposed air cooled engine

secured by simplifying rather than building light parts; the very best material and workmanship employed with a view to extreme reliability and durability.

This engine is a two-cylinder, horizontally-opposed, four cycle air cooled valve-in-head type. Bore is 5 in. and stroke 6 in., giving a piston displacement of 235.63 cu. in. The compression ratio is 433-1.

The crankcase is a two piece aluminum alloy casting split vertically and securely bolted together by standard S. A. E. ⅜ in. bolts. The engine is bolted to the fuselage by eight ⅜ in. bolts set on a large pitch diameter at the rear of the crankcase. The interior is flanged to allow cooling and gives an extremely rigid construction with light weight. The rear forms the gear case housing. The gear case cover, magneto bracket and oil pump plunger barrels are cast integrally.

The actuating mechanism consists of one camshaft with one inlet and one exhaust cam, operating four tappets each connected to its valve push rod. The tappet rollers are ball bearing. The camshaft is mounted on the outside race of a ball bearing; the inside race is mounted on the crankshaft and the camshaft is free to rotate on this ball bearing. The camshaft and gear are cut from a solid steel forging. The cam hub is driven at half crankshaft speed by internal gearing. Three idler pinions are used, mounted on ball bearings. The driving pinion on the crankshaft drives the planet pinions as well as the pump reduction gears. The push rods are of the tubular type with adjustment on one end. The rocker levers are mounted on ball bearings with the outside race cut in the lever and the inside race cut in the pin.

The cylinders are machined from solid steel forgings weighing 186 lbs. before and 11¼ lbs. after machining. Fifteen cooling fins are machined on the outside. Below the lower cooling fin eight holes are drilled equally spaced to allow air circulation to the piston head.

The cylinder head is a gray iron casting with six cooling fins cast around and nine across the head. These allow ample cooling surface over the entire head and hot valves so common in air cooled engines, are eliminated. Two spark plug bosses are provided, one on each side of the cylinder head between the valves. The head and cylinder are bolted to crankcase by means of long studs. This brings the parts under compression.

The crankshaft is machined from a solid steel forging. It is of the double throw type with crank pins set at 180 deg. and mounted on two ball bearings. The inside race of the front bearing and the two crank pin or connecting rod roller bearing races are machined on the crankshaft. The front flange for the propeller is machined integrally with the crankshaft. This shaft is of liberal size, 2 9/32 in in diameter, bored hollow throughout to insure minimum weight with maximum strength.

The connecting rods are of one piece construction machined from a solid steel forging and are of the H section. No bronze bushing is provided for the piston pin end, but these are fitted with roller bearings. The outside race is formed by the connecting rod while the inside race is the piston pin. The big end or crank pin end is solid with the outside roller race machined in the rod. This construction makes a short section which is unusually light and strong.

The pistons are cast of aluminum alloy fitted with one Inland ring above the piston pin. The piston pin is free to oscillate directly in the bosses and has bronze buttons at each end to prevent wear on cylinder wall. The crown head is strengthened by eight webs radiating from a central boss in the piston crown. The formation of these webs is such that they act as cooling fins for the air circulating through at every stroke. Between these cooling fins, and equally spaced, air circulating ports are drilled. The piston pin, on which the rollers of the small end of connecting rod run directly, is bored hollow, hardened and ground These pistons are light weight.

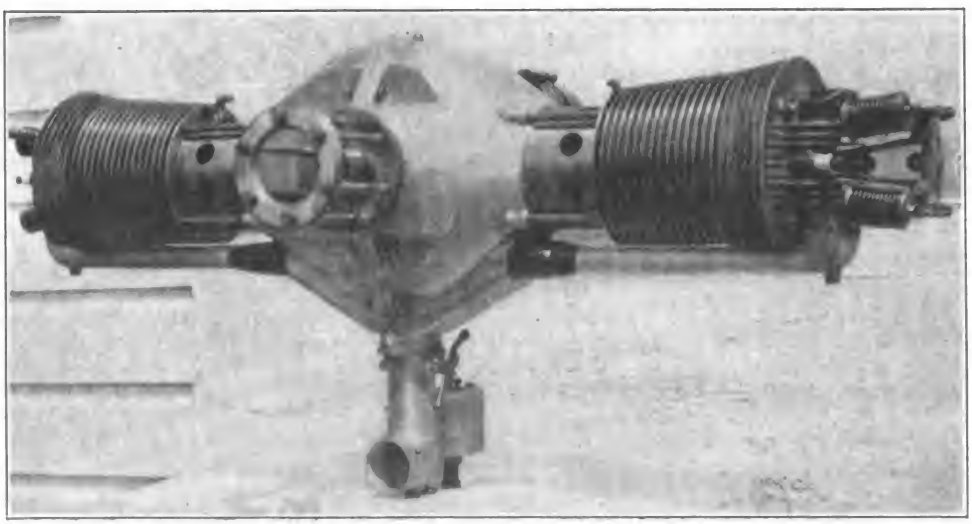

Fig. 3—Propeller end. Note cooling fins and ports in lower part of cylinder

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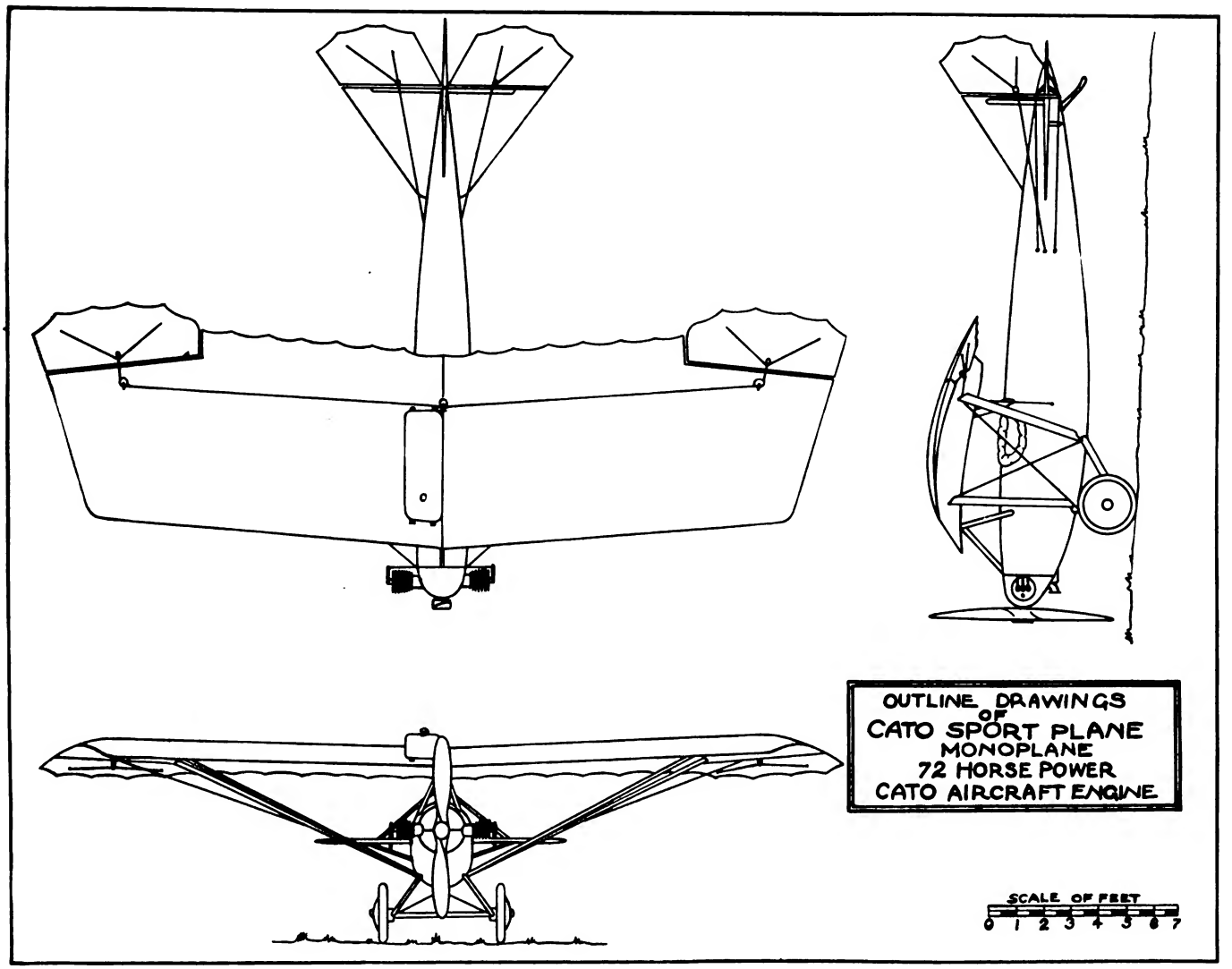

Two poppet valves are located in each cylinder head and all valves are interchangeable. The valves are 2¾ in. in diameter. Excepting that the valve stem is somewhat shorter, the valve assembly is interchangeable with that of the Liberty engine.

The oiling system is of the dry sump, non-circulating type. Oil pressure is provided by a dual plunger pump drawing oil from a supply tank in the fuselage and delivering to each of the cylinders every revolution of the crankshaft. On the down stroke oil is delivered into the gear case lubricating the oil pump reduction gears and the valve operating mechanism. The main bearings, crank pin and piston pin bearings are lubricated from oil spray in the crank case.

The ignition is by Bosch magneto mounted directly opposite the rear end of the crank shaft and driven from the end at crankshaft speed. Carburetion is secured through special Zenith carbureter, bolted directly to the crank case in which the intake manifold is cast. The manifold from crank case to cylinder head is located quite close to the cylinder, which is kept warm by the cylinder heat. This not only makes a very rigid mounting but adds materially to the cooling of the crank case and the heating of the gas.

The General Specifications of the Cato Sport Plane

General Dimensions.

Overall span	28 ft. 11½ in.
Overall length	20 ft. 10 in.
Chord	7 ft.
Areas.	
Total plane area	186 sq. ft.
Ailerons, each	11.93 sq. ft.
Stabilizers, each	7.78 sq. ft.
Fin	4.55 sq. ft.
Elevators, each	6.94 sq. ft.
Rudder	6.94 sq. ft.
Wing Curve.	
Cato	No. 4
Weights.	
Empty	474.26 lbs.
Useful load	253.00 lbs.
Fully loaded	727.26 lbs.
Load per sq. ft.	3.91 lbs
Load per horsepower	about 10.1 lbs.
Performances.	
High speed at low altitude	68 m.p.h.
Landing speed	25 m.p.h.
Climb in 10 minutes	4,500 ft.
Ceiling	12,000 ft.
Endurance at 68 m.p.h.	3 hours

Specifications of Cato Two-cylinder Engine

General Data.

Number and arrangement of cylinders	2 opposed
Included angle	180 deg.
Bore	5 in.
Stroke	6 in.
Area of one piston head	19.635 sq. in.
Total piston head area	39.27 sq. in.
Swept volume of one cylinder	117.82 cu. in.
Clearance volume of one cylinder	34.97 cu. in.
Total volume including clearance volume	152.97 cu. in.
Compression ratio	433-1
Piston displacement	235.62 cu. in.

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Horsepower....72 at 1825 r.p.m.
Type of valve gear. Overhead rocker levers and push rods
Cooling system....Air

Valves.
Valves per cylinder....1 inlet, 1 exhaust
Outside diameter....2¾ in.
Port diameter....2½ in.
Width of seat....⅛ in.
Angle of seat....30 deg.
Valve lift inlet....7/16 in.
Valve lift exhaust....⅜ in.
Diameter of stem....7/16 in.
Length of valve....4¼ in.
Number of springs per valve....2 concentric
Length of spring in position....2 3/16 in.
Mean diameter coils—large spring....1 7/16 in.
Mean diameter coils—small spring....1 in.
Exhaust rocker clearance....020 in.
Inlet rocker clearance....015 in.
Included angle of valves....13 deg.

Cylinders.
Material....Steel—machined from solid
Over-all length....10⅛ in.
Length of projecting in crank case....¾ in.
Diameter over cooling fins—Max....7¾ in.
Diameter over cooling fins—Min....6⅜ in.
Space between cooling fin centers....⅜ in.
Number of cooling fins....15
Thickness of fins....1/16 in.
Thickness of flange at base....3/16 in.
Width of flange at base....3/16 in.
Number of studs....4
Diameter of studs....⅜ in.
Studs holding....cylinder head and cylinder
Thickness of cylinder barrel....⅛ in.
Number of air circulating ports for piston cooling....8
Location of air circulating ports.
Base of cylinder equally spaced
Diameter of air circulating ports....1⅛ in.

Cylinder Head.
Material....Gray iron
Over-all height....3¾ in.
Number of cooling fins....6
Diameter over cooling fins—Max....8⅛ in.
Diameter over cooling fins—Min....7⅛ in.
Thickness of cooling fins....1/16 in.
Space between cooling fin centers....⅜ in.
Number of cooling fins across head....9
Height of cooling fins across head....1¼ in.
Thickness of combustion chamber wall....¼ in.
Thickness of valve ports....⅛ in.
Diameter at valve....2½ in.
Area of port at flange....3.142 sq. in.
Number of spark plug bosses....2

Piston.
Material....Aluminum alloy
Type of piston head....Crowned
Length of piston....4⅞ in.
Number of rings per piston....1 Inland
Position of ring....¼ in. below head
Width of ring....¼ in.
Distance from bottom to center of piston pin..3 13/32 in.
Thickness of head....3/16 in.
Cooling fins in piston head....8 equally spaced radial
Thickness of cooling fins....⅛ in.
Number of air circulating ports....8
Diameter of air circulating ports....1⅛ in.
Diameter of piston pin....1¼ in.
Thickness of piston pin boss....3/16 in.
Thickness of piston skirt....⅛ in.

Connecting Rods.
Type....Plain—solid bearing ends
Length between centers....10½ in.
Piston end bearing....roller bearing
Crank pin end bearing....roller bearing
Type of section....H
Depth of section....1¼ in.
Width of section....¾ in.
Thickness of web....1⅛ in.
Thickness of flange....1⅛ in.

Crankshaft.
Type....Double throw
Included angle of pins....180 deg.
Diameter of propeller end....2 9/32 in.
Daimeter of magneto end....1¾ in.
Diameter at crank pin bearings....2 9/32 in.
Width of crank webs....2⅝ in.
Thickness, center....⅞ in.
Thickness, sides....¾ in.
Radius of fillets....⅛ and 3/16 in.
Weight of shaft with propeller flange....15 lbs.

Camshaft.
Diameter....3⅝ in.
Length....2 1/32 in., including gear
Inside diameter....3 11/32 in.
Number of bearings....1
Type of bearing....Ball bearing
Width of cam face....¼ in.
Number of cams....1 inlet, 1 exhaust
Inlet cam operating....Both cylinders
Exhaust cam operating....Both cylinders
Pitch diameter of gear....4.20 in.
Number of teeth....84
Width of face....⅜ in.
Material....Steel—machined from solid
Camshaft housing....Box type
Material....Aluminum alloy
Planet pinion bearing....Ball bearing
Pitch diameter....1.05
Number of teeth....21
Width of face....½ in.

Crankcase.
Material....Aluminum alloy
Type....Split vertically
Thickness of wall....3/16 in.
Thickness of cylinder pads....¾ in.
Cylinder base to crankshaft center....6 9/16 in.

Valve Mechanism.
Rocker lever....Steel—cut from solid
Length over-all....4⅝ in.
Bearing....Ball bearing
Type push rods....Tubular
Adjustment clearance....One end
Length of valve tappets....2⅜ in.
Type of tappets....Square—2 in housing
Roller....Ball bearing
Width of roller....⅜ in.
Width of tappet....1 3/16 in.
Thickness of tappet....⅝ in.
Material....Steel cut from solid

Lubrication.
Type....Force feed non-circulating
Type of pump....Plunger
Number of plungers....2

Ignition.
Type....Magneto
Make of magneto....Bosch
Number of plugs to cylinder....2
Type of plug....A. C.
Ratio of magneto speed to crankshaft....1-1

Carbureter.
Make....Zenith
Size....1¾ in.

Cooling System.
Type....Air cooled

Over-all Dimenisons.
Width....46⅛ in.
Length....23 1/16 in.
Height....20¼ in.

Weight.
Complete motor ready to run....134 lbs.
Weight per h.p....about 1.86 lbs.
Pounds oil per hour at 1650 r.p.m....2 lbs.
Pounds gas per hour at 1650 r.p.m....86 lbs.
Horsepower at 1650 r.p.m....66

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Use and Abuse of Arc Welding Apparatus

By H. L. UNLAND*

THERE are several simple precautions to be observed in the use of electric arc welding equipment, whatever the nature of the apparatus may be.

Generally the accidents which occur are the result of a misconception of the nature of the equipment and its proper use. This applies more particularly to the auxiliary apparatus.

The eyes should be thoroughly protected from the light of the arc. Painful and more or less serious burns to the interior of the eye will certainly result from carelessness in this respect. No chinks or holes in the mask should be permitted, since only a brief exposure of the eyes is required to bring on painful results. The inside of the mask should be kept painted dull black to prevent reflection of the light from behind.

The mask is used principally where carbon electrode welding is being done, as in Fig. 12. It consists of a thin sheet of aluminum formed to the proper shape and provided with an adjustable band for supporting it from the operator's head. An opening in the front of the mask is provided for a window of glass. This glass may be either a number of individual sheets of different colors or a single compound sheet of glass may be used.

The colored protective glass should be sufficiently dense to reduce the light intensity to a value not objectionable to the eye and at the same time the definition of the area immediately around the arc should be clear to enable the operator to follow the work properly. Different color combinations are used but the most general seems to be a combination of red and green glass.

The glass is held in a recess in the front of the mask by means of a clamping frame secured by four small bolts. By this means it is rendered impossible for light from the arc to pass through joints or cracks around the edge of the glass. The bolts should always be in place when the mask is used as the small amount of light coming through one of these openings would in a short time affect the eyes of the operator.

To change the glass, the bolts and clamping frame are removed, the glass changed and the frame and bolts replaced. It is advisable to keep a piece of clear glass on the outside since, in welding, this outside surface will be struck by numberless particles of molten metal and will become roughened to such an extent that it becomes useless and must be replaced.

The Hand Shield

The hand shield is principally used in doing metallic electrode welding. It consists of a light wooden frame with provision for a protective glass window and can be seen in Fig. 13. The protective glass is the same as used in the mask. This shield is also used by inspectors and others who require the protection only for short periods and at infrequent intervals. A light box frame surrounding the window is fitted to the operator's face, preventing light from the side or rear reaching the operator's eyes, thus eliminating any interference of a number of operators due to the light from the arcs. The protective glass of the hand shield is supported in guides on the front of the shield and is clamped in place by a wooden wedge driven through openings in the guides.

Electrode Holders

The function of the electrode holder is to connect the electrode electrically to the cable of the welding equipment. The requirements of this service are:

1. It must securely grip the electrode so the welder can operate it without play in the mechanism or without the electrode becoming loose in the holder while being used.
2. The clamping arrangement should be such as to facilitate changing electrodes.
3. It should be constructed so that the minimum heat reaches the operator's hand.

*Power and Mining Engineering Dept., General Electric Co. With the article, The Electric Arc Welding Process, which appeared in the October, 1919, and the article, Welding Wrought Iron and Steel, which appeared in the December, 1919, issue, this completes a series of articles on welding.

Fig. 12—Welding oil stills by means of electric arc, portable current outfit at left. Note use of mask by workman

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4. The weight should be as low as possible and the balance such as to facilitate manipulation by the operator.

5. The construction should be such that the operating parts are protected from accidental contact to avoid injury by burning or by being struck.

6. The general construction should be substantial and should avoid light or flimsy parts which are subject to bending or jamming.

Fig. 13—Electric arc welding of air compressor intercoolers, work very similar to truck radiator headers. Note use of shield

Electrodes

Carbon electrodes should be rods of hard, homogeneous uncored and uncoated carbon. The diameter used will vary with the current to be used and this information is given elsewhere. The length depends on the particular class of work to be done. Long carbons reduce the percentage of short ends thrown away, but are more liable to breakage. The average lengths range from 9 to 12 in.

For welding iron and steel the metallic electrode should be a high grade of low carbon steel wire. A large number of tests were made by the Emergency Fleet Corporation to determine the best chemical analysis of wire for this purpose, and the wire now made by a number of manufacturers meets these requirements. This material can be purchased either direct from the makers or through jobbers and can be obtained either in rolls or in short lengths, cut and straightened. In ordering, "electric welding wire" should be specified since wire for acetylene welding is often treated in such a way as to render it unsuitable for electric welding.

The electrode wire should be cut into pieces convenient for the operation. A length of 18 in. is satisfactory since it is about the greatest length an operator can handle: at the same time it reduces the number of times the electrode is changed, and consequent wastage, to a minimum.

Cables

On account of the intermittent nature of the work it is possible to use smaller cable for the welding circuits than is standard for the current capacities. In this way there is also a gain in flexibility which permits better control of the welding arc by facilitating the manipulation of the electrode holder.

In metallic electrode welding a length of 15 ft. or more of extra flexible cable should be connected to the electrode holder to allow the operator to control the arc through manipulation of the holder. For the ground or return cable the standard extra flexible apparatus or dynamo cable insulated with varnished cambric for low voltage circuit and covered with double weatherproof braid has been found suitable.

The carbon electrode welding arc is not so unstable as the metallic arc and therefore the manipulation of the electrode is not so important. For this reason the standard extra flexible dynamo cable referred to may be used for connection to the electrode holder, as well as for the return circuit.

It is difficult to give universally applicable figures covering amperes, speed, etc., for electric arc welding due to the effect of conditions under which the work is done, the character of the work, and to a very large extent the skill of the operator.

The following figures are based on favorable working conditions and a skilled operator. However, they are approximations and are given merely as a general guide.

Metallic Electrode Welding

Light work.....25 to 125 amperes
Heavy work.....up to 225 amperes

Electrode diam., in.	Amperes	Correspondence Plate thickness, in.
1/16	25-50	up to 3/16
3/32	50-90	up to ¼
⅛	80-150	⅛ to ⅜
5/32	125-200	¼ up
3/16	175-225	⅜ up

The same sized electrode may be used with various thicknesses of plate; the heavier plate will require the use of the heavier currents.

Approximate speeds of welding sheet metal with the metallic electrode are given in the following table:

Thickness Plate	Speed feet per hour	Cost per foot	Comparative cost per foot Acetylene
1/16	20	2.12	1.78
⅛	16	3.12	4.66
¼	10	7.13	13.1
⅜	6.5	12.3	36.1
½	4.3	19.8	much higher
¾	2.0	41.7	much higher
1	1.4	61.3	much higher

The above figures are based on average figures for materials and labor. They will probably vary considerably for different localities and will vary slightly with the type of equipment, but the relative costs of gas and electric welding will in general hold true. Figs. 12 and 14 show plate work welded by electric arc.

Carbon Electrode Welding

The carbon electrode can be used for welding and for building up metal in a large number of cases where the metal is not subjected to high strains or where it is under compression only. This process can be used to a very large extent in rough cutting of plates and structures.

The average current ranges for different types of work are as follows:

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Light welding .....150 to 250 amps.
Medium welding .....250 to 350 amps.
Heavy welding and medium cutting.....400 to 600 amps.
Very heavy welding and heavy cutting...600 to 1000 amps.

The maximum values of current permissible for the carbon electrodes are as follows:

Diameter of Electrode	Maximum Amperes
¼ in.	100
½ in.	300
¾ in.	500
1 in.	1000

Graphite electrodes permit the use of somewhat higher current densities, but the higher cost of graphite electrodes is a serious handicap to their use. Lower currents

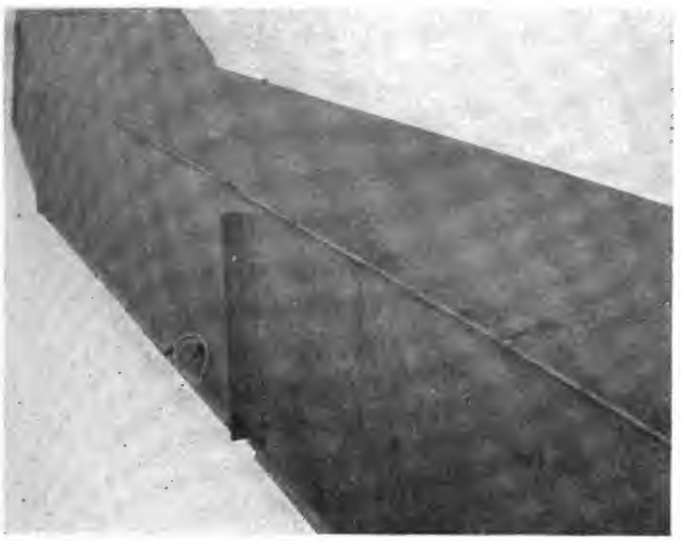

Fig. 14—Near view of electric arc welded seams on steel chute for metal chips

than the above may be used, but higher values will result in undue burning of the electrode.

For depositing or building up metal by means of the carbon arc on flat surfaces where the work is accessible and all conditions favorable, the following figures may be used:

Current, amperes	No. per hour	Cu. in. per hour
200	1½	5.4
300	3	10.8
400	4½	16.2
500	6	21.6

For continuous work the above figures may be used, but for short jobs of ten minutes or less the rate will be double the above.

Motorcycle Industry Active and Prosperous

Little has been noted in the public press, even the business and financial sections, relative to the motorcycle business, but reports from the middle west where the greatest number of motorcycle firms is located as well as from the east where the largest producer is located, indicate that all companies are doing a very satisfactory business, and making money.

It appears that the motor cycle manufacturers are enjoying their proportion of motor driven prosperity. The Hendee Mfg. Co., Springfield, Mass., for instance, has enough business on its books to insure practically capacity operations during the greater part of 1920. The amount of orders booked through its English and other foreign connections is especially heavy and gratifying. Domestic business already contracted for exceeds the expectations of the management. In addition to motor cycles, the company is beginning the manufacture of motor wheels on a large scale.

The company is about three months behind on deliveries owing to its lateness in getting started on regular line work following its war-time contracts, and to the steel and coal strikes as well as the labor and other factors. Today it is turning out about 75 machines per day, or at the rate of something less than 500 per week; or on an annual basis of something like 22,500, as compared with 25,000, the normal output. Approximately 2,200 hands are employed as against 2,700 during the war time.

New York Body Makers Strike Settled

The strike of the body makers and painters in automobile and truck body building shops in New York and Brooklyn, which began in the middle of October, 1919, has been settled and the men are at work again. Their original demands have been pared down in the settlement, but the men go back with a 15 per cent raise for all men earning less than $25 a week, and 10 per cent increase for all men earning more than $25 a week, which includes the majority. The question of hours was arbitrated, and the men go back on a 44-hour basis. When they started work on February 9 they had been out of work continuously for 17 weeks. It is needless to add that the body work of the metropolis has been completely tied up for that length of time.

Hardwood Kiln Drying Requires Perfect Heating System

Successful kiln drying of hardwood lumber green from the saw necessitates a very even control throughout the kiln at all times. This means that variations in temperature of even a few degrees or variations in relative humidity of 5-10 per cent are seldom permissible. Such uniformity is possible only when the heating coil is properly drained is relieved of air, and is distributing heat uniformly along its length.

It is the contention of the Forest Products Laboratory, Madison, Wis., that the return-bend heating coil system, by bringing about more uniform distribution of heat in the kiln, enables the operator to obtain quicker and better drying than is possible with the header-coil system, as it is generally installed.

The return-bend heating coil gives a practically even heat distribution under any steam pressure. The header-coil produces different temperatures at either end of kiln, the extent of variation depending on the steam pressure, length of coils, drainage, traps, etc.

Refractory hardwoods require low temperatures, and the lower the temperatures used the more evident will be the difference in the results obtained with these two types of heating equipment. Under the same careful operation green hardwood lumber may be turned out from kilns using the one type satisfactorily dried, and from kilns using the other type checked and overdried at one end and molded and underdried at the other end.

The Forest Products Laboratory at Madison, Wis., is determining the gluing and kiln drying qualities of ten Brazilian woods, whose suitability for furniture manufacture is a question of interest to the United States Department of Commerce and to the furniture industry in general.

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Timber Preservation by the Zinc Chloride Steeping Process

Frequently small amounts of timber are to be used under conditions that favor decay, when it is inexpedient to have the timbers treated at a commercial treating plant, and yet where a simple and inexpensive preservative treatment is desired. Coal-tar creosote is easily applied, but this preservative may be objectionable on account of its color or odor, or the possible fire risk involved. It is in such cases that the zinc chloride steeping process may be used to advantage.

The steeping process can not be expected to make wood as durable as impregnation under pressure, because the absorption and penetration of the preservative are usually not as thorough. Furthermore, a water-soluble preservative like zinc chloride can not be recommended for timbers which are exposed continuously or frequently to the leaching action of standing or running water.

If the timbers are to be used where there is little leaching action of water, even if they are in direct contact with damp ground, the zinc chloride treatment may be expected to add more than enough to their length of life to justify the cost of treatment. It should be borne in mind, however, that much better results and usually greater economy can be obtained by the use of timber thoroughly treated under pressure, and commercial treating plants should be employed whenever conditions permit.

Apparatus Required—About the only special apparatus required in the steeping process is a sheet iron, wood, or concrete tank long enough so that the largest sticks to be treated can be submerged in it.

Preparation of Timber—Only absolutely sound timber should be used and it should be thoroughly seasoned before treatment. If the wood is seasoned but wet from snow or rain, it should be dried out again before treating.

The timbers should be cut to final dimensions and all boring and framing done before treatment if possible. In case it is necessary to cut into the timbers after treatment, all faces exposed by the cutting should be painted with two coats of hot coal-tar creosote or with two coats of a strong solution of zinc chloride.

Mixing the Steeping Solution—Zinc chloride can be purchased either in solid form or in a 50 per cent water solution. For treatment by the steeping process it should be dissolved in water to form a 5 per cent solution. This can be done by mixing 5 lbs. of the solid zinc chloride and 95 lbs. of water, or 10 lbs. of the 50 per cent solution and 90 lbs. of water. The solid form absorbs water from the air rapidly and will soon dissolve itself in this way. It should, therefore, be mixed in solution as soon as the package is opened.

Method of Treatment—As the timbers are being piled into the vat, stickers should be placed between the courses so that the preservative solution will be able to reach every part of each stick.

It is customary to allow the wood to soak one day for each inch of thickness and one additional day. Thus, a 1 in. plank should soak two days, one 6 in. thick seven days, a 12 in. timber 13 days, and so on. Longer steeping, however, would probably result in better absorption and penetration of preservative, and when time is not an important factor it would be advisable to use a longer soaking period.

Seasoning After Treatment—If the timbers are to be used in contact with the ground, in damp places, or in places where slight shrinkage would be objectionable, they should be seasoned for a week or two after treatment before being used.

Comparative Durability of Green and Seasoned Timber

Opinions of wood users have always differed as to the comparative durability of untreated green and seasoned timbers when used for poles, posts, or ties. Recent experiments conducted by the Forest Products Laboratory indicate that there is practically no difference in the relative durability of untreated green and seasoned timbers when exposed to the weather and in contact with the ground.

The following service records of ties laid by the laboratory in co-operation with the Northern Pacific Railway bear out this conclusion.

Life of Green and Seasoned Ties

Place	Species	Green or Seasoned	Average life in years
Maywood, Wash.	Douglas fir	Green	7.7
	Douglas fir	Seasoned	7.8
Plains, Mont.	Douglas fir	Green	7.6
	Dougals fir	Seasoned	7.7
	Western larch	Green	7.3
	Western larch	Seasoned	7.4

In each of these cases the average life of seasoned ties was only one-tenth of a year longer than that of the green ties. This difference is obviously so slight as to be negligible.

Periodical measurements on poles made by the laboratory in co-operation with the American Telephone and Telegraph Co. show that the rate of decay in green poles is a trifle less than in seasoned poles.

The fact that green and seasoned timber have the same durability when used in exposed places is easily explained Moisture content is the principal factor in determining the rate of decay of a stick of timber. As soon as the timber is placed it begins to take up or give off moisture, according to its condition of seasoning and the conditions of exposure. Within a relatively short time in exposed construction both green and seasoned timber reach the same moisture content.

When used in buildings, however, wood does not usually dry out rapidly after being placed. Wood for interior construction must be seasoned before use, otherwise it is likely not only to shrink to a serious extent but also to decay before it seasons. Very expensive building repairs have been necessitated by the use of green timber.

Nearly a Million Employed in Automobile Industry

At present there are about 550 or more vehicle manufacturers in the United States, who with 6,789 concerns manufacturing some article used in the automobile trade employ more than 830,000 persons, half as many as are employed by all the railroads, and approximately 8 per cent of all the people engaged in manufacturing and mechanical industries. The number of persons dependent upon this industry is almost 3,000,000. There are in use in this country alone more than 6,400,000 automobiles and approximately 600,000 motor trucks. These motor vehicles have paid to the states almost $60,000,000 in fees during the past year. (More accurate estimates show 7,600,000 cars and trucks registered).

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Helpful Hints for Designers and Draftsmen

Useful Tools Made From Old Files

Several times mention has been made in these columns as to what could be done in the way of salvaging old files. When a person looks into this subject it really is surprising what can be done with the useful metal contained in an old and apparently useless file. A number of these uses have been listed down as follows, Fig. 1 showing these. The letters refer to those given in the figure:

A useful cold chisel may be made from a worn out flat file. Take a low heat on the tip end of the file. Be very sure not to heat it to a bright red or the steel will be damaged or spoiled. File steel can not be heated very hot. It is not a very good grade of steel at best, and it must be worked at a low red heat and must not be hammered while cold or black hot.

Draw down the end of the file as at A; do not let the steel get too wide. Keep it down, edgewise, by hammering upon the edge B. Keep the file square upon the anvil or it will become diamond shaped and it will be hard work to square the tool again. Hammer alternately the sides and edges, turning the tool over often so as to hammer on all sides instead of upon two sides only; the other two sides bearing upon the anvil will not be shaped so well as if all sides are hammered in turn.

Cut off the tang of the file, leaving a small portion at C to serve as a head. Grind sharp corners from this end and remove the sharp edges of the tool from one end to

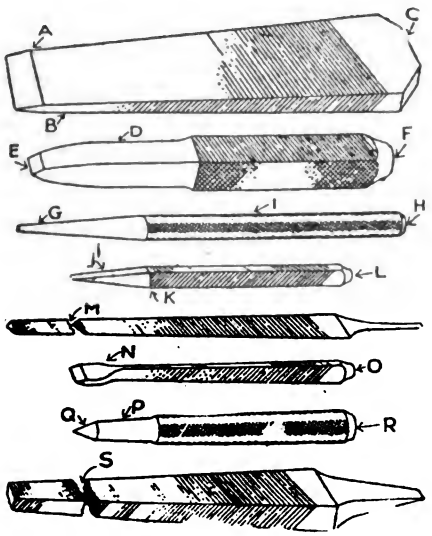

Fig 1--Some of the manifold uses for worn-out files

the other. This will make it easier to handle. Grind the cutting end, A, almost to an edge before tempering. It is almost impossible properly to temper a cutting edge, so leave a very little thickness until after the hardening.

Heat to a cherry red; this is not a bright red, but near to it. To temper the tool, two ways are used. One way is: When quenching the hot steel which has been heated for some distance along the body of the tool, hold only the end of the steel in the cold water, moving it around and up and down a trifle. As soon as the end of the tool is cold remove from the water and brighten the steel by rubbing upon the ground or on a piece of stone; then watch the color run down. First the tool will be white, then straw color, then violet, then blue. When the point of the tool is between straw color and blue, dip in water for an instant. Do this two or three times and then cool the entire tool.

A better way of tempering a tool, but one which takes longer, is to heat and quench the entire tool end. Have ready a large piece of iron or steel, evenly heated to a red heat. Hold the tool near the hot metal until the color begins to run, and when the entire cutting end is purple, or thereabouts, quench slowly. By this method the tool has been tempered as far as hardened, while by the first method only the end or cutting edge is tempered.

A good cape chisel may be made from square file S. Break off the small end by striking the file with the hammer as it lies across the corner of an anvil. Then forge one end narrow and thick as shown at D. After tempering, the tool may be ground as indicated at E. Do not fail to forge the hammer end of the tool as at F, but do not harden this end of any tool which is to be driven with a hammer lest particles fly therefrom and injure or destroy an eye.

Small chisels for digging out broken set-screws may be made from three-cornered files. The chisels may be of the variety as at L, or of regular chisel shape same as is shown at O. To make these break off a file as at M. In either case do not forget to chamfer the heads as at L and O, and on the cape chisel a little grinding may be necessary, as it is not always possible to forge a bevel smoothly unless with a helper and a set of swages.

A square punch for holding a horseshoe may also be made conveniently from a square file, or from a round one. Simply hammer down the end of the file to fit one of the nailholes in a shoe, and the tool-holding punch is ready for use in trying a hot shoe against a hoof.

Convenient punches of almost any size may be made from old round files as shown at I. Draw down one end to suit as at G, and corner the other end H.

When making a round punch never try to draw it down round. Draw it square and round the tool the very last thing before hardening. If you attempt to draw down a round section you surely will fail. The steel will split into two or more pieces and you will find it utterly impossible to make a good punch. After drawing down to a square section, round the corners with as little hammering as possible.

Another very convenient tool which is easily made from an old round file is the center punch R. Corner the hammer end, R, forge the other end to a straight bevel, then harden and grind the point to 60 deg. as shown at Q.

On all the tools described, the file teeth have been left. Hammering will flatten down the teeth, but will not remove the cracks between them. The only sure way of removing file teeth is to grind them off. But in the tools described the file teeth form fine grips for the hand.

Capitalization of American Industries

The following article and tabulation relative to various American industries is taken from Machinery. It would seem that the amount set down opposite vehicles is far from the total capitalization of all the automotive companies in this country, in fact our guess would be that

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this figure should be multiplied by three at least. However, as the figures stand, and granting their correctness, they show that the automotive industry must have the largest percentage of profit of any on the list, for the annual turnover has exceeded two billions for several years.

The total amount of capital invested in the railroads and the industries in the United States has been estimated to amount to about $39,000,000,000. This capital is distributed among the various industries as follows:

Railroads (value of roads and equipment)	$16,145,532,000
Iron and steel	4,281,998,000
Chemicals	3,034,209,000
Textiles	2,810,848,000
Food	2,174,387,000
Lumber	1,723,456,000
Paper and printing	1,433,176,000
Beverages	1,015,715,000
Metals (other than iron)	1,013,632,000
Stone, clay and glass	987,328,000
Vehicles	803,496,000
Leather	743,347,000
Railroad repair shops	417,706,000
Tobacco	303,840,000
All other industries	2,047,842,000

Around the World in Three or Four Days

The recent feat of a French aviator who traversed space momentarily at the rate of nearly four miles a minute gives considerable point to some recent statements by Brigadier-General William Mitchell, in which he suggested that some day it may be possible to attain speeds in the airplane which will carry us around the world in three or four days. In the course of a very powerful appeal at the Flying Club, New York, on behalf of the bills now before Congress for the formation of an independent air department of the government, the general referred to the good work which has been done by the engineering section of the air service since the armistice. Reference was made to the turbo-booster, which makes it possible to deliver additional air to the carbureter at great altitudes, and to the variable-pitch propeller. An ordinary airplane using the booster has already ascended with a passenger over 30,000 ft, and General Mitchell is convinced that within a comparatively short time an altitude of 40,000 to 50,000 ft. will be attained.

Now at that height of eight or nine miles, the extreme rarity of the atmosphere involves a corresponding decrease in resistance to the flight of an airplane and, of course, a decreased amount of oxygen in a given volume of air. An oxygen respirator would supply the pilot, a turbo-booster the engine, and sufficient reaction against the tenuous atmosphere would be obtained by the use of the variable-pitch propeller.

General Mitchell, who was commander of the air service in the American Expeditionary Forces, tells us just what will be the result of these up-to-date combinations: "It seems probable, therefore, that by the use of the variable-pitch propeller, which can be set for the maximum climb to get to these high altitudes, and after the altitude has been arrived at, can be changed so as to give the maximum amount of horizontal speed, the swiftness of locomotion of airplanes at a high altitude will be greatly assisted because of the lessened resistance of the air. It seems probable that speeds of from 300 to 400 miles an hour may be expected." This, it may be remarked, would allow an airplane to cross the Atlantic in six or seven hours and to make the trip around the world in three days, provided that the apparently insuperable problem of fuel supply could be overcome. Astounding as these figures are he would be a bold prophet who attempted to set a time limit to the accomplishment of this altitude and speed. Developments in aviation have been going forward at such an ever-accelerating rate that it is conceivable we are even now merely at the threshold of accomplishment.

How close this may be is seen in considering that the Frenchman's momentary speed was at the rate of a circle around the earth, on the basis of a distance of 30,160 miles, which allows for a considerable height, in 8,000 minutes, or 5½ days.

The Octaval Notations Combine Fractions and Metrics

Of late there has been considerable agitation relative to the American and British adoption of the metric system, and much talk and paper has been wasted proving that the change would be either good or bad. An English manufacturer of measuring instruments is out with a novelty, the Octaval rule in which he proposes to give all the advantages of both systems. Fig. 2 shows a short section of the rule and its method of dividing. This is something more than a new pattern instrument; it is a suggestion for an advance in notation, and indicates how British and American engineers can continue to use the fractions they prefer, but label them in a really scientific notation. It is proposed to follow up the Octaval rule with micrometers and calipers marked with this simple notation. The Octaval engineers' rule is an old friend with a new face. It gives the British binary division of quarters, eighths, etc., down to sixty-fourths, but labels them with a simple, logical notation in the 8 grouping.

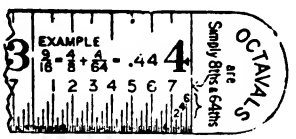

Fig. 2—Section of the new octaval rule combining eights and metrics

Quick Repair for Frozen Water Pipes

With the approach of winter and freezing weather comes the possibility of frozen water pipes. Just at the time when your pipes freeze your neighbor is probably having the same trouble and it is a race to see who can get the plumber first.

To guard against the inconvenience of being without water for an extended time, keep on hand in the house a small quantity of litharge and a little glycerin to tide over an emergency.

When a pipe freezes and bursts, drain all the water out of it so that the cracked parts will become dry. Mix some of the litharge with glycerin, bringing it to the consistency of putty or thick paste. Press some of the paste into the cracks with the fingers and daub a thick coating of it over the crack. Let it dry over night and then turn on the water.

It is said that pipes repaired in this way will often last many years without giving further trouble.

A committee of the Merchants' Association of New York, in attempting to standardize export practice, is seeking to increase the compensation of many government officials, and to make many other needed changes.

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How to Obtain Gasoline Economy

Obtaining the greatest possible number of miles per gallon of gasoline from your car is a matter of both personal and patriotic interest.

First, a great deal can be saved by the driver of the car, such as throttling down the motor whenever possible, not permitting the motor to idle at the curb for extended periods of time, not attempting to make the motor work under extremely difficult pulling conditions, or picking up on high gear in traffic.

Second, various derangements about the motor should be promptly eliminated. If the motor misses, a condition is produced which is not conducive to gasoline economy.

Ofttimes an owner will find it necessary, due to extremely cold weather or some condition about his car, to prime the motor before starting, particularly mornings. In this priming considerable gasoline is used, which ofttimes an owner does not take into consideration when figuring mileage.

Of course, the proper adjustment of the carbureter is responsible largely for the mileage obtained, but it is necessary that the ignition adjustments be correctly made also.

In cold weather there are indications of water in the carbureter. This may be brought about through condensation due to changes of temperature. Water in the gasoline is very disagreeable and may be serious. It doesn't take any longer and doesn't cost any more to be served with filtered gas. Some gasoline pumps have a water separator built in which takes all of the water and dirt out of the gasoline as it is delivered. It pays to play safe and buy only filtered gasoline.

In winter weather the motor should be kept in a warm garage if possible. It can easily be realized that with the motor warm the gasoline economy will be the greatest. Extensive experiments have shown that with the water at a temperature of 170 deg. F. the best economy of gasoline is secured. In cold weather with the temperature 10 to 20 deg. above zero, without the hood or some portion of the radiator covered the temperature of the water averages 120 deg. F. For this reason the owner should cover up a sufficient portion of the radiator and hood to insure running at a temperature of 170 deg. F.

Asbestos in Canada in 1918

A very large quantity of the asbestos used in the United States comes from Canada, that is the raw material from which is made our automobile and truck brake bands, clutch facings, pipe coverings, etc., comes from our neighbor to the north.

The production of asbestos has increased very greatly during the past four years, and average prices in 1918 were about three to four times those of 1914. As usual the production has all been derived from Black Lake, Thetford, Robertsonville, Coleraine, East Broughton and Danville in the Eastern Townships, Province of Quebec.

There was a falling off in 1918 of 1,955 tons in the output and 1,691.4 tons in the sales of crude asbestos, but an increase in average price from $510.47 per ton in 1917 to $671.28 in 1918. The shipments of mill stock were increased in 1918 by 7,651 tons and the average price was increased from $34.08 in 1917 to $46.88 in 1918.

The total value of the shipments of asbestos and asbestic in 1918 was $8,970,797, as against $7,230,383 in 1917.

The average number of men employed in mining was 1,674, and in milling 1,400, or a total of 3,074, and the total wages paid was $2,871,643. The tonnage of rock mined and quarried was 2,462,381 and the tonnage milled 2,185,572.

Exports of asbestos during 1918 were 119,454 tons valued at $7,786,710, or an average of $65.19 per ton and of asbestic sand and waste, 22,144 tons valued at $228,059, or an average of $12.99 per ton. There was also an export of manufactures of asbestos valued at $40,763. In 1918 there were 10,346 tons valued at $894,367 exported to Great Britain, 99,182 tons valued at $6,114,510 to United States, 3,821 tons valued at $352,594 to Italy, 1,500 tons valued at $119,874 to France, and 4,605 tons valued at $305,365 to other countries.

The imports of asbestos and manufactures of asbestos in 1918 were valued at $604,703.

Drying Schedule for Air Seasoned Oak

The following skeleton drying schedule is recommended for the kiln drying of air-seasoned oak. It must be remembered, however, that no mere formula in itself will insure the perfect drying of wood. The kiln operator must be trained to watch the condition of the lumber and to apply the proper remedies if things start to go wrong.

The schedule was prepared by the U. S. Forest Products Laboratory for 4/4 plain-sawed oak (highland variety) with a moisture content of 15 per cent. This moisture condition would ordinarily be reached in from 9 to 12 months of air seasoning.

Stage of kiln run in hours	Temperature, degrees F.	Humidity, per cent
1	120	100
6	120	100
12	125	85
24	125	80
36	130	70
48	130	60
60	135	60
72	135	60
84	140	60
96	140	50
108	140	50
120	140	40
144	140	40
156	145	35
168	145	35
180	145	30
192	145	25
Until dry	145	25

After the stock is dry, the temperature should be held at 145 deg. and the humidity raised to 80 per cent. This condition should be maintained for 10 hours in order to balance the moisture content, thus reducing the tendency of the lumber to warp after machining.

A recent British combine has a capital of approximately 30 million dollars and includes: Harper Sons & Bean, makers of the Bean car; Swift, Ltd., manufacturer of the Swift car; Vulcan Motor & Engineering Co., which produces the Vulcan cars; Tipton & Smethwick, parts manufacturers, and British Motor Trading Corp., a large distributing company.

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Simple Bus Body for Ford Chassis

(Continued from page 12)

13 x 2 x 2, and six crossbars of 2 ft. 9 in. These crossbars are mortised into the uprights. There are two panel boards screwed to the uprights and crossbars, the panels being on the inside and running the full length of the body.

The flooring consists of four sills, 4 x 2 in., two end sills of the same stock, and three floor boards of 1¼ in. stock. The seats for passengers are hinged to the side panel, as shown at E. F is an ordinary swinging bracket which can be folded flush with the sides of the body when the seat, H, is swung up, in order to leave the body clear for other work. G is a hook which holds the seats up when not in use, one on each end of the seat.

J is the driver's seat, which is only half the width of the body, leaving a space on the side for hand baggage, etc., in addition to the space under the seats when passengers are being carried. At the rear of the body are two end panels, as shown in the view C. There are two roof rails 9 ft. 8 in. by 2 x 2, and two cross rails, one at each end, 4 ft. 2 in. by 2 x 2. The roof bows are secured to these rails.

All these plans may be varied considerably to meet special demands to be made upon the body, or individual ideas of the maker or purchaser; and to use any other stock that may be on hand or easily obtained rather than the size specified, provided it will have the necessary strength and fit in with the rest of the construction. Particularly with regard to the steps at the rear is this true. They are shown mounted rigid, but need not necessarily be so. They may be detachable, provided with runners for sliding them under the floor, or may be collapsible.

Another thing to be remembered, says Blacksmith and Wheelwright, is that extra leaves must be added to the rear spring, or a heavier spring substituted, if the car is to be ordinarily used to its full capacity. The regular Ford spring will stand up well with a load of five or six people, but with eight or nine people a stronger spring is necessary. The rest of the chassis, including the power plant, will handle the additional load very satisfactorily, even on rough roads and in hilly country.

Death of R. C. Ware

Ralston C. Ware, president of the Ware Bros. Co., publisher of the Vehicle Monthly and other trade journals, and for many years one of the most prominent figures in the vehicle industry, died February 4 from pneumonia shortly after his return from the south. The funeral took place from his home in Wayne, Pa.

Ralston C. Ware was born at Allowaystown, N. J., January 18, 1860. After graudating from the public schools he took an academic course at Pennington Seminary. As it was his father's wish that his sons should learn a trade he took up printing and this enabled him to give a good account of himself when in later years he became active in the management of the publication founded by his father, Isaac D. Ware.

When the publishing company was incorporated in 1903 Mr. Ware became its president and held this position until his death. In this capacity he became well acquainted with the personnel of the several lines of industry covered by the publications of the company and particularly so in the carriage and automobile building trades. He was a very familiar figure at the annual conventions of the Carriage Builders' National Ass'n which he attended regularly and among whose members he had hosts of friends.

Among his home activities his church claimed a large share of his interest. He was one of the founders of the

RALSTON C. WARE
Late President Ware Bros. Co.

Wayne Methodist Episcopal Church. He was a leader in the work of a men's club, which has done much for the men and boys of his community.

World's Highest-Powered Diesel Engine

(Continued from page 19)

finished with a hollow square inside into which a square plug may be inserted for turning the nut. This scheme results in a gain of at least 12 in. of head room, as it is only necessary to raise the head about 3½ in. to clear the studs. All valve springs, except the relief valve, are placed below the rocker arms, none being visible in the illustrations. The links operating the secondary or loose eccentric bearings of the fuel and air starting rockers for each cylinder are visible. Each fuel valve rocker is seen to work on the inside of the camshaft. This gives the desired lightening effect to the valves at the other end of the rockers. Thus when the fuel valve rollers are swung away from their cams the air rollers approach theirs.

Special attention is called to the fuel valve cams. They are only half rings inserted in grooves, and by means of a screw adjustment at each end of the cam any desired position within limits may be given to the nose of the cam This adjustment can, of course, only be made with the engine stopped and would seldom be used except for a great change of oil fuel characteristics, etc.

A very compact yet quickly accessible design for supporting the rocker arm shaft, yet providing for breaking the joint between each cylinder head is fitted. A coupling is provided having a journal finish on the outside with the clamp bolts and flanges outside of the bearing. The pedestals that carry both the rocker shaft and camshaft bearings between each pair of cylinders is very tall, lightly built and unstable looking, but as always any suggestion as to weaknesses may quickly be answered by pointing to the excellent service given by this type and by smaller engines placed in Germany's submarines.

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Death of Franklin Murphy

Franklin Murphy, former governor of New Jersey, and founder of the Murphy Varnish Co., of Newark, N. J., died February 24 at the Royal Poinciana Hotel at Palm Beach, Fla., following a surgical operation. The New Jersey Senate adjourned for the day out of respect to his memory.

THE LATE FRANKLIN MURPHY
Former Governor of New Jersey

For many years Mr. Murphy attended the conventions of the Carriage Builders' National Association and took a conspicuous part in its activities. He took special interest in the Technical School for Automobile Body Makers and Draftsmen carried on by the C. B. N. A. and later by the N. A. C. C., and as chairman of the executive committee of the school contributed liberally of his time and means.

Mr. Murphy was born in Jersey City on January 3, 1846. He quit school when 16 years old and enlisted as a private in Company A, 13th Regiment, New Jersey Volunteers. Three years later he was mustered out as a lieutenant. He entered the varnish business and established the Murphy Varnish Co., of which he was chairman of the board of directors when he died.

He married Janet Colwell in Newark in 1868. She died in 1904. They had two children, Franklin Murphy, Jr., and Mrs. Helen M. Kinney, both of whom are living.

From 1883 to 1886 Mr. Murphy was a member of the Board of Aldermen of Newark and became its president. He was unanimously nominated for governor in 1901 by the Republican state convention and was elected.

In Mr. Murphy's term as governor the first primary law and first child labor law were enacted, and the first law regulating the ventilation of workshops was put on the statute books. There were also passed the Tenement House Commission act, the act establishing the tuberculosis santitarium at Glen Gardner and acts to abolish the fee system in state and county offices.

President McKinley offered the post of Ambassador to Russia to Mr. Murphy, but it was declined. Mr. Murphy was a member of the executive committee of the Republican national committee for 17 years. In 1908 he received 158 votes for vice-presidential nominee at the Republican national convention. He was delegate to five Republican national conventions.

For 20 years Mr. Murphy was chairman of the Republican state committee. He was a member and one time president-general of the Sons of the American Revolution. He was a member of the Society of Colonial Wars, the Loyal Legion, the G. A. R., the Society of the Cincinnati and a Freemason. He held the degree of LL.D. from Princeton and Lafayette universities.

Preliminary figures for the commerce of the United States in 1919 show an even greater excess of exports over imports than in 1918. Financial men were in hopes that this movement would decrease, and in this way remedy the exchange situation. The total commerce was $11,826,253,884, as compared with $9,180,300,255 in 1918. The excess of imports was $4,017,441,226, as compared with $3,117,874,835 in 1918. This year's exports totalled approximately eight billions in round figures, $7,921,847,555 to be exact.

Current Automotive Metal and Supply Prices

General Business

Blizzard weather, shortage of freight cars, influence of the influenza epidemic, strength in sterling following market weakness of all foreign exchange, easier call money rates, splendid retail business, are high spots of the past month in a general way. The shortage of freight cars, which is nation-wide bids fair to be the biggest item in the list if not soon remedied.

Iron and Steel

Pig iron production in January was very large and steel output is much larger also. The demand is so strong, however, that the increased output has not been noticed. Prices have moved up generally, with the exception of the Steel Corporation, which is maintaining the March 21st or Industrial Board schedule. Increased prices have been no deterrent to large buying, as the big question has been and still is delivery of actual metal. Ore is up $1 a ton, bar iron $10, bars $5, forging billets $9, soft steel bars for automobile use almost 1c a pound.

Copper and Aluminum

Copper demand has eased off, especially domestic. Foreign buyers are operating on the hand-to-mouth plan, because present exchange rates are so unfavorable to them. Some second hand copper on the market in small lots is bringing about 19c. Producers are quoting higher than this and are maintaining their prices despite the fact that demand has fallen off and quite a few orders have been withdrawn from the market. The average price of Lake in

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January was 19.52c. Aluminum is normal at 31½ to 32½ New York for 98-99 virgin metal.

Lead, Tin, Antimony

Lead continues quiet, with very light demand and very little actual buying. Stocks in second hands are small, but production is better and just about equals demand. Tin has reflected the weakness of sterling and consequently has been steadily declining. On February 3 it had reached 59c, having declined steadily sicne January 22. Buying has been very light, consumers staying out of the market to catch the low figure. Arrivals in January were 4,195 tons, with 5,030 tons reported afloat. Antimony is strong but very quiet, with prices unchanged. Late in January there was a shortage.

Zinc and Other Metals

Foreign exchange has affected zinc but not to the same extent as tin. Prices are down slightly, however, in this country with London prices increased a very little. Some experts claim the market is topheavy and prices must fall before quantity business can be done. Ferromanganese is in strong demand and considerably higher. From $150 domestic has gone to $155 and several interests are now asking $160 for 76-80 per cent, with the intimation of higher figures. Spiegel is higher with very little available. Silver continues around the high figure, being quoted at $1.34 an ounce. New York on the 11th, and in London the same day made a new high record of 89½d.

Old Metals

Old copper and brass are down, as is zinc. Steel and cast scrap, on the other hand, are up for the second week in succession. Local dealers are not anxious to sell and are predicting a shortage of all grades of scrap.

Chemicals

Heavy chemicals are in big demand, and as in the case of iron and steel, the question is one of delivery not price. All spot chemicals are scarce. Coal-tar products show an even greater shortage. The waxes are quiet. Naval stores continue to move upward, turpentine having reached $2.04 with no sign that this is the top.

Fabrics

Cotton yarns are quiet, raw cotton is lower for the moment, but cotton fabrics are steady. London is shipping back to this country both raw cotton and finished fabrics, an unusual situation. Wool is steady. Burlap is active but slightly easier in price.

Other Materials

Rubber is not in demand but the price has held fairly steady. It followed sterling down somewhat and recovered with it. Rubber smoked sheets which were 53½c a month ago are now 49¼ for spot. Practically all the leathers are quiet, but prices hold to the level, Bogotas being still quoted at 48. Large purchases have been made quietly for foreign accounts, and more are in prospect. The expansion of foreign motor car construction is pointed out as a field for both natural and artificial leathers in quantities. Crude petroleum is up 50c a barrel and the refined products will shortly reflect this increase.

The prevailing prices compared with last month's are as follows. Every effort is made to have these as accurate as possible, but none are guaranteed. Many are obtained through trade sources dealing in large quantities, so these may not be realized on smaller quantities:

	Jan. 13	Feb. 9
Acid, Sulphuric, 66°.....ton	$22.00 —25.00	$22.00 —25.00
Alcohol, Wood, 97 p.c.....gal.	1.52 — 1.57	nominal
Alcohol, denatured, 190 proof, gal.	.71 — .78	.71 — .73
Aluminum, Ingots No. 1 99% pure, carload lots.....lb.	.35 — .38	.35 — .38
Ammonium Chloride (Sal-Ammoniac) white, granular....lb.	.13¼— .17½	.13¼— .17½
Antimony, Asiatic .....lb.	.11½— .12½	.12½— .13½
Babbitt Metal, best grade.....lb.	.90	.90
Babbitt Metal, Commercial....lb.	.50	.50
Beeswax, natural crude, yellow.lb.	.42 — .45	.42 — .45
Carnauba No. 1 Wax.....lb.	.80 — .88	.80 — .88
Caustic Potash (85-92 p. c.)..lb.	.35 — .42	.35 — .42
Caustic Soda, 76 p. c.....100 lb.	4.10 — 4.35	4.35 — 4.50
Copper, Lake, ingot.....lb.	.22 — .23	.19½
Copper, Electrolytic .....lb.	.21 — .22	.19¼
Copper, Casting .....lb.	.20½— .21	.19
Lead, Pig .....lb.	.09½— .10	.09½— .10½
Lead, Bar .....lb.	.10½— .11	.10½— .11
Pumice, Ground (domestic)....lb.	.02½	.02½
Shellac, TN .....lb.	1.10 — 1.15	1.10 — 1.15
Orange, superfine .....lb.	1.20 — 1.30	1.20 — 1.30
Solder, No. 1.....lb.	.40	.40
Solder, Refined .....lb.	.36	.36
Tin, Metallic straits pig.....lb.	.65 — .68	.66
Turpentine, spirits of crude.....	1.76 — 1.85	2.04
Zinc, Western Spelter.....lb.	.10½— .11	.10½— .11½
No. 9 base casks, open.....lb.	.14	.14½

IRON AND STEEL, PIG, BARS, ALLOYS

	Jan. 13	Feb. 3
Pig, per ton—		
No. 2 X, Philadelphia§.....	$44.35	$44.35
No. 2, Valley furnace†.....	39.00	40.00
Basic, delivered, eastern Pa.....	39.25	41.40
Basic, Valley furnace.....	37.00	40.00
Bessemer, Pittsburgh	40.40	42.40
Malleable, Valley	38.00	42.00
Bars—		
Merchant iron, base price.....	.....	4.25c
Refined iron base price.....	4.00—4.25c	4.25c
Soft Steel—		
¾ to 1⅞ in., round and square..	3.52—4.00c	3.52—4.25c
1 to 6 in. x ⅜ to 1 in.....	3.52—4.00c	3.52—4.25c
1 to 6 in. x ¼ and 5/16.....	3.62—4.00c	3.62—4.35c
Rods—⅝ and 11/16.....	3.57—4.05c	3.57—4.05c
Bands—1½ to 6 x 3/16 to No. 8..	4.22—4.75c	4.22—4.75c
Ferromanganese, 76% to 80% delivered producers' price.....	$145.00	$155.00 to 160.00
Spiegel, 18% to 22% furnace, spot	43.00 to 45.00	55.00 to 57.50
Ferrosilicon, 50%, spot, delivered	85.00 to 95.00	85.00 to 95.00
Ferrotungsten, standard, per lb. contained, furnace	1.25 to 1.40	1.25 to 1.40

†Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.
Ferrosilicon prices at Ashland, Ky., Jackson and N. Straitsville, O.

OLD METALS

	Jan. 13	Feb. 9
Copper light and bottoms.....	16.75c	12.50—12.75c
Brass, heavy	14.00c	7.50— 8.25c
Brass, light	10.00c	5.80— 6.60c
Heavy machine composition.....	19.00c	15.50c
No. 1 yellow brass turnings.....	12.00c	10.00c
No. 1 red brass or composition turnings	16.50c	13.00c
Lead, heavy	7.50c	6.75— 7.00c
Heavy steel scrap, Pittsburgh...	$26.00	$28.00
Heavy steel scrap, Philadelphia..	24.50	26.50
No. 1 cast, Pittsburgh.....	32.00	34.00
No. 1 cast, Philadelphia.....	35.00	41.00

BOLTS AND NUTS

	Jan. 13 % off list	Feb. 3 % off list
Machine bolts h.p. nuts, ⅛ x 4 in.: Smaller and shorter, rolled threads	50-10	50-10
Cut threads	50	50
Machine bolts, c.p.c. and t. nuts, ⅛ x 4 in.: Smaller and shorter.....	40-5	40-5
Carriage bolts, ⅛ x 6 in.: Smaller and shorter, rolled threads	45-5	45-5
Cut threads	40-5	40-5
	per lb. off list	per lb. off list
Hot pressed nuts, sq. blank.....	2.50c	2.50c
Hex., blank	2.50c	2.50c
Sq., tapped	2.25c	2.25c
Hex., tapped	2.25c	2.25c
Semi-finished hex. nuts:	% off list	% off list
⅛ in. and larger.....	65	65
9/16 in. and smaller.....	70-10	70-10
Tire bolts	60-10	60-10

The above discounts are from November 1, 1919.

BRASS AND COPPER SHEETS AND SHAPES

	Jan. 12	Feb. 9
Copper sheets, hot rolled.....lb.	$0.29	$0.29½
Copper sheets, cold rolled.....lb.	.31	.31½
High brass wire and sheets....lb.	.26	.25¼
High brass rods.....lb.	.25	.23¾
Low brass wire and sheets....lb.	.28¾	.27¼
Low brass rods.....lb.	.28¾	.28
Brazed brass tubing.....lb.	.37¼	.37
Brazed bronze tubing.....lb.	.42	.41¾
Seamless copper tubing.....lb.	.33½	.33½
Seamless bronze tubing.....lb.	.38	.34½
Seamless brass tubing.....lb.	.32	.30½

CRUDE RUBBER

	Jan. 12	Feb. 9
Para, Upriver fine.....lb.	$0.48¼—$0.50	$0.44 —$0.46
Upriver coarse .....lb.	.35 — .37	.33 — .35
Upriver caucho ball.....lb.	.34½— .36	.33½— .34½
Plantation, first latex crepe...lb.	.53½— .54½	.50 — .54½
Ribbed smoked sheets.....lb.	.53½—	.49 — .51
Brown crepe, thin, clean....lb.	.48 — .48½	.48 — .48½

PETROLEUM PRODUCTS

	Jan. 12	Feb. 10
Oil—Pennsylvania Crude	$5.00	$5.50
Kansas and Oklahoma Crude.....	3.00	3.00
Gasoline, Motor, garages, steel bbls.....	.26½	.26½
Consumers, steel bbls.....	.28½	.28½
Lubricating Oil, black, 29 gravity.....	.20—.22	.25—.35
Cyl. light filtered.....	.55—.60	.60—.70
Dark filtered	.50—.56	.60—.70
Extra cold test.....	.65—.70	.70—.80

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Men of the Automotive Industry

Who They Are What They Are What They Are Doing

W. K. Swigert has been appointed general factory manager Oakes Co., Indianapolis, Ind., manufacturers of automotive cooling fans and special metal stampings. Swigert is a production man with 25 years' experience in the automobile industry in the middle west. In 1912 he became general superintendent of the Chalmers factory in Detroit, resigning after six years to become superintendent of production on the Liberty airplane motor in the mammoth Nordyke & Marmon plant at Indianapolis. Early in 1919, after all work on the Liberty motors had been completed, Swigert joined the Dort Motor Car Co., Flint, Mich., where he was in charge of engine production up to the first of the year.

Lawrence M. Brile, who has been connected with the United Smelting & Aluminum Co., Inc., New Haven, Conn., as vice-president and sales manager for the past five years, severed his connection with that company on January 1 to assume the presidency of Brile & Ratnor, Inc., a New York corporation formed to engage in the metal and chemical brokerage business. Mr. Brile has charge of the nonferrous end of the business, and Mr. Ratnor, one of the best known men in the chemical industry, has charge of the chemical department. The office of Brile & Ratnor, Inc., is located temporarily at 115 Broadway, New York.

B. G. Koether, for 18 years with the Hyatt Roller Bearing Co., has been made a vice-president of the company. His new post, which is in fact an expansion of his sales work, is regarded by his friends in the industry as a direct result of the efforts of Koether during the past ten years while he has been serving as sales manager of the company, with his headquarters at Detroit. He will shortly leave that city, returning to the company's main plant at Harrison, N. J., where the first eight years of his connection with Hyatt were spent, and from which he will now direct all of the company's sales and advertising work.

F. B. Clark, eastern sales manager for the General Ordnance Co., has been promoted to vice-president of the same company. Mr. Clark has had charge of the eastern sales of the G-O tractor since he resigned his commission as major in the ordnance department of the army, where he had charge of a special department for small arms ammunition production. For practically 13 years previous to this he was associated with the Remington Arms-Union Metallic Cartridge Co., occupying various progressive positions, including that of general manager of the U. M. C. Swanton works.

E. W. Besaw has been appointed general sales manager Firestone Tire & Rubber Co., Akron, O., and L. G. Fairbank has been promoted to be vice-president of the Firestone Steel Products Co. and general manager of that rim making branch of the Firestone enterprise. Besaw, who has been for three years western sales manager of the company, with his headquarters at Akron, has ahead of him the problem of merchandising the company's planned output of $150,000,000 of tires and accessories for the coming year. He joined the organization nine years ago as a salesman.

H. D. Wilson has been appointed vice-president of the Herschell-Spillman Motor Co., N. Tonawanda, N. Y., and will assist in the administration of its expansion program, which calls for an increase in production from 40 to 200 engines a day. Before joining Herschell-Spillman, Wilson was sales manager for the Bijur Motor Appliance Co., of Hoboken. He had previously served in the automobile business since 1902, being successively employed by the Olds Co., Packard Motor Car Co., Eisemann Magneto Co., and Ferro Machine & Foundry Co.

Jay E. Morehouse has joined the Stromberg Motor Devices Co., Chicago, as a special representative of the sales department. His headquarters will be in Chicago from which point he will cover the country generally, calling on the factory trade. Morehouse has had many years' experience in the automobile and accessory field, having at one time been sales manager of the Apple Electric Co., Dayton, O., and more recently associated with the Scripps-Booth Corp. as manager of the Detroit branch.

Edw. F. Sullivan, designer and chief engineer of the Homer Laughlin Engineers Corp., has been appointed chief engineer of the Stockton Tractor Co., of Stockton, Cal. He will produce a creeper attachment for the Stockton wheel tractor, and a special built creeper tractor to be used in the cultivation of sugar cane. The Homer Laughlin Engineers Corp. has discontinued its factory at Los Angeles and will have the Laughlin tractor built by a corporation in the east.

Arthur T. Murray, president of the Bethlehem Motors Corp. since its inception, has relinquished the title to Hiram F. Harris, general manager at the Allentown plant and will hereafter be solely identified with the American Bosch Magneto Corp., which he now serves as president. This action leaves Mr. Murray to devote his entire effort to the building of the American Bosch Magneto Corp. to the same high standard he built the Bethlehem Motors organization.

H. H. Bassett, who assumed the duties of general manager of the Buick Co., following the elevation of Walter P. Chrysler to be executive vice-president of the General Motors Corp. last spring, has been confirmed in that office and elected president of the company. Much of the construction under the new building program is already under way, its total cost running to about $7,500,000 at Flint and $3,000,000 at St. Louis.

Frank M. Germane has been elected a vice-presdent of the new Standard Steel and Bearings, Inc., which was organized a few months ago to consolidate the various Marlin-Rockwell plants into one operating organization. Germane for many years was closely identified with what was formerly the Standard Roller Bearing Co., having acted at different times as assistant general manager and director of sales.

Erwin Frudden has been appointed chief engineer of the Hart-Parr Co., Charles City, Ia. For the past year Mr. Frudden has occupied a similar position with the Buda Co. He was connected with the Hart-Parr Co. for a number of years prior to 1914. In that year he resigned to join the Parrett Tractor Co. In 1917 he enlisted in the army and was assigned to the ordnance department.

H. H. Doehler has been reelected president of the Doehler Die-Casting Co., of Brooklyn, N. Y. These officers were also reelected: H. B. Griffin, vice-president; O. A. Schroeder, treasurer; O. A. Lewis, assistant secretary. They also added to their list of officers the following: J. Kraiund, second vice-president, in charge of production, and Charles Pack, secretary and chief chemist.

J. E. DeLong has been appointed motor engineer by the Indiana Truck Corp., Marion, Ind. The Indiana corporation recently acquired the Rutenber Motors, with which DeLong was connected as engineer. During the war DeLong served in the A. E. F., where he helped organize the first U. S. motorized ammunition train, and remained with the organization during hostilities.

C. B. Voorhis, general sales manager, and J. T. Wilson, assistant manager, have been elected vice-presidents of the Nash Motors Co., Kenosha, Wis., and W. H. Alford, already a vice-president, has been elected a member of the board of directors. Each of the three, of course, retains his direct touch with that branch of the Nash business in which he has been concerned.

Lee Madden has been appointed general sales manager of the Stover Mfg. & Engine Co., Freeport, Ill. The appointment represents a promotion, as Mr. Madden has been assistant sales manager and has been connected with the sales department for a number of years. He is well and favorably known to many dealers and jobbers throughout the country.

P. J. F. Batenburg, for ten years identified with the automotive engineering field, has been made chief engineer of the Mitchell Motors Co., Inc., Racine, Wis. By education and training familiar with European practice, Batenburg came to this country in 1910, becoming prominently known as chief engineer of the Four Wheel Drive Auto Co., Clintonville, Wis.

G. S. Salzman, factory manager and treasurer of the Grant Motor Car Corp., Cleveland, O., has been appointed a director and secretary of the Toledo (O.) Automotive Products Co., which was recently incorporated to manufacture high grade screw machine and hardened and ground products for the automotive industry.

William W. McMahan, whose accession to the force of the Ajax Rubber Co., Inc., was made known in November, has been selected to take charge of the new Ajax plant at Sandusky, O. McMahan will be a vice-president of the company, and the plant under his care will be operated as the Sandusky division of Ajax.

E. W. Bernhard, for a number of years associated with the Hess-Bright Mfg. Co., Philadelphia, as planning manager, has been promoted to assistant to the general factory manager. H. W. Jackson, who has also been identified with the concern, has been promoted to factory manager.

E. A. Bates has severed his connection with Benecke & Kropf to become president and general manager of Booty Carbureter & Mfg. Co.

A. L. Pschalden, Detroit motor truck engineer, has become assistant engineer of the Reynolds Motor Truck Co., Mt. Clemens, Mich.

Paul R. Beardsley, secretary and treasurer Muskegon Piston Ring Co., has been elected mayor of Muskegon, Mich.

Earl V. Higbee has been appointed assistant chief engineer of the Locomobile Co. of America, Bridgeport, Conn.

Louis J. Schneider has been appointed general sales manager of the Clark Trucktractor Co., Chicago, Ill.

R. DeVere Hope has entered the organization of the Duratex Co. as industrial engineer.

OBITUARY

Theodore H. Douglas, president and consulting engineer of the Duplex Engine Governor Co., Inc., died January 21 at his home in Scarboro-on-the-Hudson, N. Y., after an illness of four months. He was 51 years old. Mr. Douglas was well known in the automotive field as the inventor of the Duplex governor and other mechanical devices. Prior to his connection with the Duplex company he served as president of the Hudson Equipment Co. He was a graduate of Yale University and held membership in several prominent engineering and educational societies throughout the country. He was one of the first subscribers to Automotive Engineering.

Leo G. Benoit, technical manager of the Tips Aero Motor Co., Inc., Woonsocket, R. I., died January 3, 1920. He was born in that city June 4, 1888, and received his education in the local schools, later graduating from a special course in mechanical drawing and mathematics. His practical experience included progressive stages of drafting and machine design with several different firms. In 1916 he became associated with the Tips company, which was incorporated at that time, in the development of a new 400 h.p. aviation engine and had charge of its design and construction at the time of his death.

Darwin S. Hatch, well known throughout the industry, is dead in Chicago of pneumonia following a cold contracted at the New York automobile show. Hatch, who was 37 years old, was a Purdue University man, and was active in the Society of Automotive Engineers, having been one of the organizers of the mid-west section of that society. He had been in trade journalism throughout his active career, and was managing editor of Motor Age at the time of his death.

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Activities of Automotive Manufacturers

Where They Are Located What They Are Doing How They Are Prospering

Dorris Motors Corp., St. Louis, Mo., a new $3,000,000 organization incorporated in Delaware, has taken over the Dorris Motor Car Co. and the Astra Motors Corp., of that city. The former is widely known; the latter was organized recently to assemble the Astra car, 3,000 of which have been contracted for by the Associated Motors Corp., New York, for export. B. R. Parrott, formerly director of sales and advertising, Inland Machine Works, is president and treasurer; A. J. Kessinger, vice-president of the Newson Valve Co., manufacturers of automobile tires in St. Louis, is vice-president, and A. H. Mansfield, general claims attorney of the Missouri Pacific Railroad, and vice-president of the Bank of Hartville, Hartville, Mo., is treasurer of the new corporation. The new organization will continue to manufacture the Dorris trucks and passenger cars on an increased production basis in the factory building of the Dorris Motor Car Co. at Forest Park boulevard and Sarah street, while an additional factory building will be erected at the northwest corner of these streets for the manufacture of the Astra cars. Plans have already been drawn by the Wiedmer Engineering Co. to erect the new Astra plant, which will be a three-story building, 180 x 200 ft. At present the Dorris Motor Car Co. empolys 443 people. This will be increased to 1,000 by July 1, Parrott states.

Baker Rauch & Lang Co., Cleveland, O., manufacturer of electric-operated automobiles, has plans under way for the construction of a new branch plant on property recently acquired at Williamsett, Mass. The initial unit will be one story, brick and steel, about 300 ft. long. The Rauch & Lang factory, when completed, will occupy a large part of the 18-acre tract purchased especially for the purpose. It will adjoin the new Stevens Duryea plant, and will be but a short distance from the new factory of Rolls-Royce. The new company has been chartered and will be known as Rauch & Lang, Inc. No announcement has yet been made of the complete personnel of the new organization, but it is understood that men closely identified with Rauch & Lang in the past will head the new company. Harry H. Doering, one of the pioneer electric car men of the country, formerly sales manager of the Ohio Electric Car Co., and for the past seven years with the Rauch & Lang organization as sales manager, and in other executive capacities, is vice-president and general sales manager of the new company.

Society of Professional Automobile Engineers, a strong New York organization of chauffeurs, has taken possession of the property on West 64th street, New York, which is to be the location of the new clubhouse. These officers were installed at a recent meeting: President, William Nelson; first vice-president, George Cook; second vice-president, Al Seeger; recording secretary, Stephen O'Brien; financial secretary, Albert Haggerty; treasurer, William Simons; chairman of examining board, David McIlveen. Members of the building committee are. Chairman, Walter Laymon; attorney, Gaylord Smith; secretary and treasurer, Frank Grinnell, Edward I. Traphagen, Albert Haggerty, David McIlveen and William Simons. The society is raising a $250,000 bond issue in order to erect the new clubhouse, which will be strictly modern in all its appointments. It will be a six-story building, with a dignified exterior, and all arrangements inside for the convenience and comfort of ts members.

Mercer Motors Co., recently organized, has concluded arrangements to take over the manufacture of the Simplex car, which was discontinued by the Crane-Simplex Co. during the war. As was disclosed last month the Mercer company has acquired a controling interest in the Locomobile Co. of America, which is undergoing reorganization. Thus, with the Mercer car as a substantial foundation and the Locomobile and Simplex cars under its control, the reorganized Mercer company becomes one of the most important factors in the higher priced passenger car field.

Colonial Motors Corp., Boston, Mass., has been organized with a capital of $5,000,000, and will purchase two factories in Boston and Springfield. Melvin F. Hill, 144 Clark road, Brookline, Mass., is president, and James W. Milne, 25 Elliot street, Watertown, treasurer. The board of directors includes Messrs. Hill and Milner, George S. Hollister, Boston, and Charles W. Dodson and Earl E. Beveridge, of Springfield, Mass. According to present plans the company should be on a full operative basis by March 1.

Garford Motor Truck Co., with factories at Lima, O., announces that the capital stock of the company has been increased from $5,000,000 to $10,000,000 to provide for expansion by 100 per cent within the next year or so to meet increased demand. Detailed plans are not as yet complete, but one of the first steps will be to erect a factory addition, 100 x 400 ft., to be devoted to assembling of motor trucks.

Harrisburg (Pa.) Mfg. & Boiler Co. is reported to have made arrangements with the Hurlburt Motors, Inc., 2413 Third avenue, New York, maker of heavy duty motor trucks, whereby the facilities of the Harrisburg plant have been rendered available for the manufacture of Hurlburt trucks. During the war the Harrisburg works turned out gun carriages and railroad car mounts for heavy artillery.

Oshkosh (Wis.) Motor Truck Co. has increased its capital stock from $500,000 to $1,500,000 for the purpose of erecting a new manufacturing plant, work on which will begin about March 15. The first building will be 80 x 310 ft., of brick and steel. Considerable new machine tool and other equipment will be required. William A. Besserdich is president and chief engineer.

United States Automotive Corp., Connersville, Ind., has been organized with a capital of $10,000,000 to merge and act as a holding company for the Connersville Foundry Corp., the Lexington Motor Co., Ansted Engineering Co., and the Tector-Hartley Motor Corp. It plans to manufacture a complete line of motor vehicles and parts. Frank B. Ansted is president.

J. I. Case Plow Works Co., Racine, Wis., will award contracts soon for a new malleable iron foundry, 150 x 300 ft., 40 ft. high, with 46,200 sq. ft. of floor space, costing $110,000; and a new gray iron foundry, 130 x 360 ft., 38 ft. high, containing 46,800 sq. ft., and costing $120,000. H. M. Wallis is president.

Schofield Tractor Corp., Ltd., Toronto, has been incorporated with a capital stock of $1,000,000 by David I. Grant, Bank of Hamilton Building; Mervil MacDonald, 72 Alexandra boulevard; Edwin Smily, and others, to manufacture tractors, motor vehicles, engines, machinery, etc.

Hackett Motor Car Co., Burlingame, Mich., has been reorganized and the name changed to the Lorraine Motors Corp. The 1920 model of the company will be known as the Lorraine. The plant is to be increased. The product now is reported as two cars daily.

Republic Motors, Ltd., Toronto, has been incorporated with a capital stock of $350,000 by Bruce I. Card, 106 Langley avenue; Harry G. Beemer, 19 Elm avenue; John W. Payne and others, to manufacture motor cars, motor engines, etc.

Gramm-Bernstein Motor Truck Co., Lima, O., plans to double its working force, B. A. Gramm announces. He says recent orders justify large expansion. The company will employ between 300 and 500 more men the coming year.

Marsh Motor Car Co., Cleveland, O., has been organized to take over the Sterling Motor Car Co., and will produce the Marsh Four, a car with 106 in. wheelbase, and four-cylinder motor of 150 cu. in. piston displacement.

Halladay Motors Corp., Newark, O., has placed contract for a new plant, including an assembling building, 60 x 400 ft., a parts building 60 x 300 ft., stock room 60 x 60 ft., office building, etc. The estimated cost is $175,000.

American Implement Co., Elyria, O., is planning the erection of a new plant for the manufacture of small tractors. It recently increased its capital stock from $300,000 to $2,000,000.

Franklin Tractor Co. has moved its offices from Franklin, O., to Greenville O., where it will erect a one-story factory, 100 x 200 ft.

Railway Motor Car Co. of America, Hammond, Ind., will build a power plant 40 x 70 ft., and a machine shop 100 x 250 ft.

Parts Makers

Fairfield Mfg. Co., Lafayette, Ind., has been organized to manufacture differential and bevel gears for automobiles. The officers of the new company, all of whom are prominent in the Ross Gear & Tool Co., makers of the well known Ross steering gears, are D. L. Ross, president; J. W. DeCou, vice-president and general manager; Edward A. Ross, secretary; George C. Kumming, treasurer, and David E. Ross, consulting engineer. The organization of the Fairfield Mfg. Co. is the result of the tremendous growth of the Ross Gear & Tool Co. A part of the Ross factory facilities have heretofore been devoted to the manufacture of the differential and bevel gears that will now be produced by the new organization. D. L. Ross and Edward A. Ross, both well known to the automobile manufacturing industry, will continue as president and secretary respectively of the Ross Gear & Tool Co., while they will hold the same position in the new company. D. E. Ross, who invented and deisgned the Ross steering gear, will act as consulting engineer for both corporations. Active management of the Fairfield organization will be under the direction of Mr. DeCou and Mr. Kumming. Mr. DeCou has been factory manager of the Ross Gear & Tool Co., and was formerly associated with the Smith Form-a-Truck Co. and the Thos. B. Jeffery Co. as purchasing agent and later as factory manager. Mr. Kumming, who has been assistant treasurer of the Ross organization, will have charge of the business management and office organization of the new company.

Aluminum Castings Co., Cleveland, O., has been reorganized under the name of Aluminum Manufactures, Inc., with the additional capital needed to extend and develop the manufacture and marketing of aluminum, brass and bronze products. The new company, besides taking over and continuing to operate the plants of the Aluminum Castings Co., is planning to construct an aluminum forging plant and other plants for making finished aluminum products, the latter being largely the development of the research laboratories of the Aluminum Castings Co. The management of the new company will be the same as that of the Aluminum Castings Co. and with its increased facilities will be in better position than ever before to keep pace with the constantly increasing demands for the various forms of aluminum products.

Mirroscope Co. and the Bailing Tie Buckle Co., which is located in the Mirroscope plant, will be merged under the name of the United Stamping & Machine Co., which has been incorporated with a capital stock of $267,000. The Mirroscope Co. has been engaged in the manufacture of automobile parts and the new company will manufacture these parts more extensively and make heavier stampings than have so far been produced. The plant will be enlarged and considerable new equipment will be added. George W. Furth, who has been at the head of the two companies, will be president of the United Stamping & Machine Co. Directors include Mario Powell, Frank A. Herman, J. Horace Jones and D. R. Wilkin.

Keuka Industries, Inc., which recently took over the motor factories of the Curtiss Aeroplane & Motor Corp. at Hammondsport, N. Y., has elected these directors: Glenn H. Curtiss, Hammondsport; K. B. MacDonald, Buffalo; J. H. McNamara, Hammondsport; Hugh Satterlee, New York; L. J. Seely, Hammondsport. With the

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exception of Mr. Satterlee the directorate is composed entirely of men who for years have been connected with the Curtiss Aeroplane & Motor companies. Mr. Seely has been several years sales manager of the Curtiss companies; Mr. McNamara has been manager of the Hammondsport plant since 1912; Mr. MacDonald has been production manager of the Curtiss plant at Buffalo.

Hamilton & Hansell, Inc., 13 Park Row, New York, will hereafter devote itself to metallurgical and general engineering work. In conjunction with domestic work, the company will carry on development of foreign patents and enterprises. A separate company, the American Tansmarine Co., has taken over the general export and import business not relating to engineering. For five years Hamilton & Hansell have been licensees and builders of the American Rennerfelt electric furnace for ferrous and nonferrous work and have also designed a number of electric reduction and electro-chemical plants.

Frank J. Edwards and George H. Williams, of Milwaukee, who have been engaged for several years in manufacturing motor truck attachments for passenger car chassis, as the E. & W. Mfg. Co., 325-335 Oregon street, have organized two corporations, as follows: E. & W. Co., capital stock, $125,000, and Frank J. Edwards, Inc., capital stock, $50,000. The articles of both concerns provide privileges of manufacturing motors, motor vehicles, boats, engines, etc.

Otto Heins and **A. R. Cline,** stockholders of the old Bosch Magneto Co., have brought suit against A. Mitchell Palmer, former alien property custodian, Francis P. Garvan, present custodian, and Martin E. Kern. This action demands an accounting, and requests that the sale of the assets of the company to Kern be rescinded.

Automotive Parts Co., 1509-1511 Bates street, Indianapolis, will build an addition, 100 x 200 ft., to cost $50,000. The building will be extended another 200 ft. as soon as the present unit is completed. The company manufactures fans for automobile trucks and tractors.

Elbridge Automotive Corp., Buffalo, manufacturer of marine engines, is planning to extend its operations to include the production of engines for automobiles and motor trucks. Arrangements have ben made to equip a local factory for these products.

H. C. Doman Co., Oshkosh, Wis., sustained an estimated loss of $10,000 by fire in the cupola building of its gray iron foundry. Repairs are under way. The company makes internal combustion engines and specializes in marine motors.

Reus Brothers Co., 146-150 West Mount Royal avenue, Baltimore, Md., machinist, has awarded a contract for a plant 75 x 250 ft., for the manufacture of piston rings, etc., to cost about $75,000. Burkhard J. Reus is president and manager.

Nolan Standard Muffler Co., New York, has been incorporated with a capital stock of $350,000 by G. B. Brooks, P. B. Barringer, Jr., and P. Huetwohl, 166 Dean street, to manufacture metal mufflers for automoblies, etc.

Pittsburgh Aeroplane & Motor Co., Kohler Building, Pittsburgh, has plans under way for an aeroplane motors and parts manufacturing plant at Meadville, Pa., to cost over $1,000,000. Charles L. Sanford is president.

Gill Piston Ring & Sales Co., 1522 South Grand avenue, Los Angeles, has filed notice of organization to manufacture piston rings. Charles W. Monahan, Jr., 1324 Bond street, heads the company.

Timken-Detroit Axle Co. is planning an extension to its malleable iron foundry in Canton, O., doubling the present capacity of the plant and involving an expenditure of approximately $500,000.

Brown-Lipe-Chapin Co., Syracuse, N. Y., manufacturer of gears, transmissions, etc., is completing plans for a six-story addition, 70 x 300 ft., on West Fayette street, to cost $300,000.

Quaker City Motor Parts Co., Tioga and Richmond streets, Philadelphia, has filed plans for a one- and two-story addition, 27 x 122 ft., and 46 x 58 ft., to cost about $25,000.

Zenite Metal Co., 201 North West street, Indianapolis, will erect an additional factory, one story, 200 x 420 ft. It manufactures windshields and other automobile parts.

Timken-Detroit Axle Co., 136 Clark street, Detroit, is taking bids for the erection of a one-story shop addition, 60 x 170 ft., at its plant, McKinstry and Fort streets.

Body Builders

Waterbury Body Co. has been organized in Thomaston, Conn., for the wholesale manufacture of all kinds of automobile bodies, making a specialty of bus bodies. The company has acquired a temporary building and machinery has been ordered for its equipment. A new site is being sought for the erection of a factory should the business warrant it. About 100 men will be employed at the start. Incorporators are Karl Eckhardt, president, and L. M. Raffel, secretary.

Ohio Body & Blower Co., Cleveland, O., during February will occupy its new plant and by March 1 the company's body production will be doubled. Later in the spring it is proposed to commence activities in still another plant so that by July 1, 1920, the company should reach its scheduled capacity of 30,000 bodies a year.

Connell-Erben Body Corp., Clarks Summit, Pa., capitalized at $50,000, has been formed to manufacture automobile bodies, models and molds. E. B. Morse, Clarks Summit, Pa.; Edgar W. Connell and Lewis Erben, Scranton, are the incorporators.

Frederick R. Wood & Son, Inc., New York, has been incorporated with a capital stock of $200,000 by J. C. Konrad, A. Beutler, Jr., and C. W. Wood, 205 West 19th street, to manufacture automobile bodies, parts, etc.

Auto Metal Body Co., Springfield, Mass., contemplates making some alterations at its plant for the manufacture of bodies. It recently purchased the Stoddard Service station.

Mullins Body Co., Salem, O., manufacturer of automobiles bodies, has completed plans for the erection of a new plant, to cost about $500,000, including equipment.

Briscoe Motor Corp., Jackson, Mich., has acquired the plant and business of the John Bohnet Co., Lansing, manufacturer of automobile bodies.

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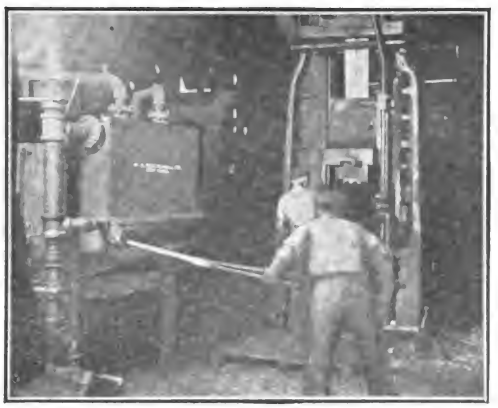

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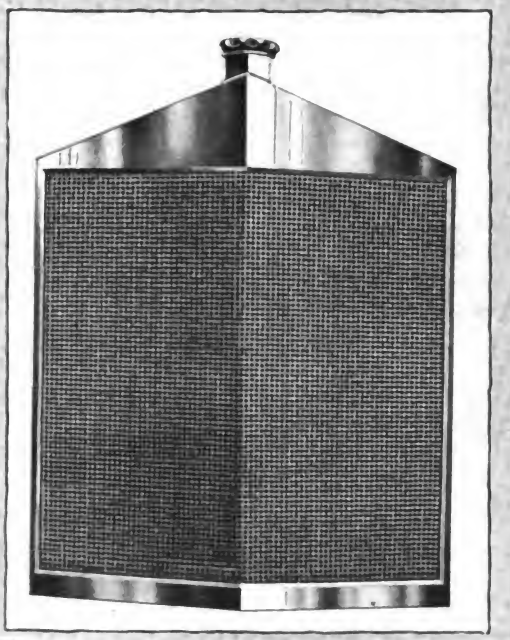

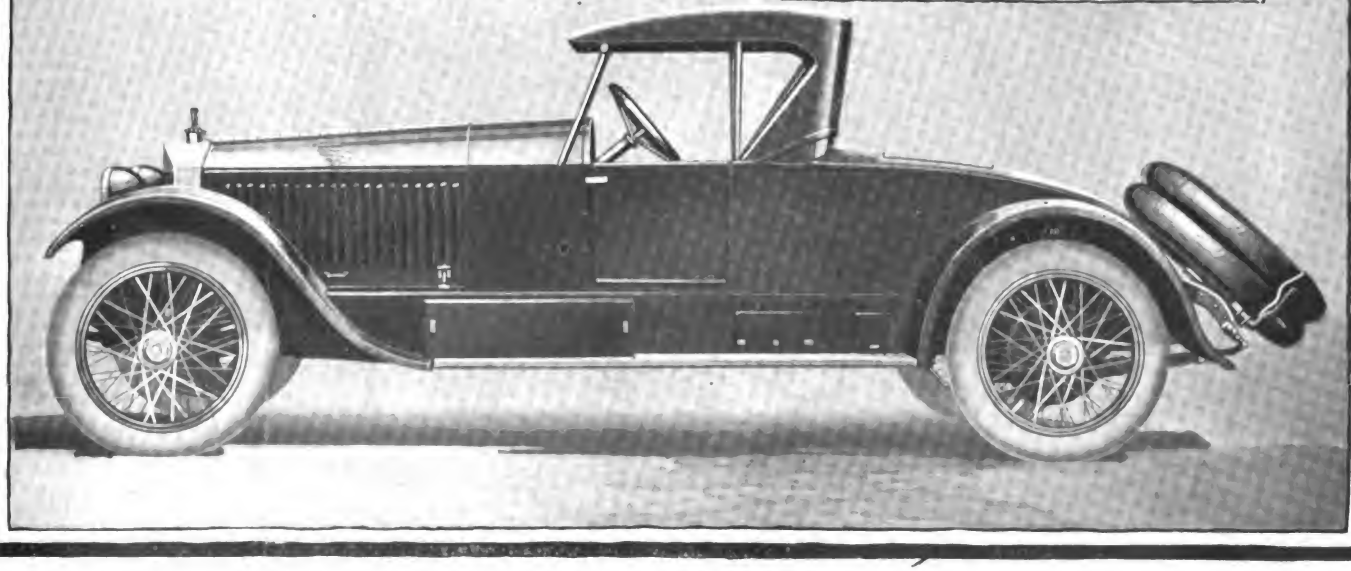

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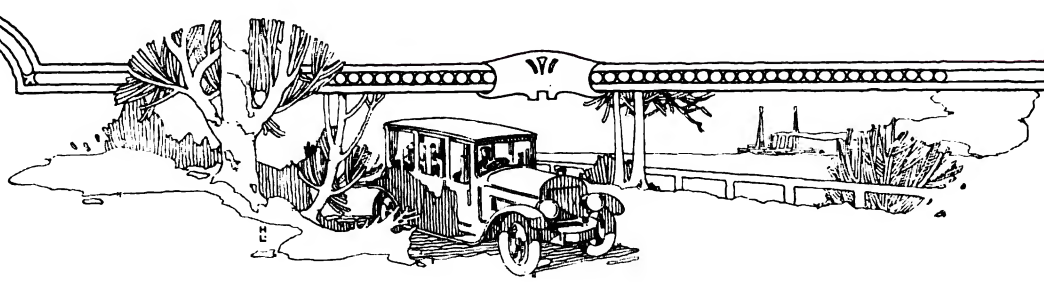

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The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

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Many New Features in Lanchester Luxury Chassis

The Second of the British Post-War Designs, Which Is Comparable With the Best American Machines—Direct Lubrication of Wrist Pins, Unusual Mounting of Electrical Equipment, Overhead Valves, Two Wheelbases

EVEN the most conservative designers recognize that the new models must show some changes, for even if the war has taught us nothing, the single fact remains that the fuel situation has changed to a remarkable extent so that the minimum of changes which a car could show and keep abreast of the times would be an altered carbureter and vaporizing system, with perhaps some change in the combustion chambers and possibly in the exhaust system. The conservative car designers, which naturally includes those of all the more expensive cars, have made as many forward steps, however, as have the designers of less expensive, and consequently less complete machines. As an outstanding example of this there is presented a description of the Lanchester car for 1920.

This is one of the finest of British cars and has always appealed to an exclusive and wealthy clientele. Its make-up has been such as to satisfy this class of people, both as to advanced design and in the way of materials and workmanship. In fact, in many ways Lanchester has been a leader, many of the ideas which are now generally adopted having been advanced by him many, many years ago. Thus, he was one of the first to use wire wheels, cantilever springs, overhead valves and forced lubrication, all of which are to be found on this latest model, of course.

For 1920 only one type of chassis will be constructed, but this will be supplied in two lengths of wheelbase, namely 141 and 150 in. Both of these will have a 58 in. tread, and both will be powered with the same Lanchester-made motor, with six cylinders, cast in blocks of three, overhead valves and camshaft, 4 in. bore and 5 in. stroke, giving a rating of 40 h.p. The chassis without body sells at about £1,500 ($6,500 at normal exchange rates). The doubt as to the exact price refers rather to the very unsettled conditions existing in all British manufacturing and touching everything which requires the product of the foundry, or in fact requires labor of any kind. More correctly the figure given represents the price at which the manufacturer. The Lanchester Motor Co., Ltd., Armourer Mills, Montgomery street, Birmingham, England, would sell his product if nothing interfered. For one thing, the British public is interfering to a large extent by buying all the cars in sight regardless of price, so that many makers, Lanchester among them, find themselves sold up many months ahead, a condition which has never existed previously in the British motor trade.

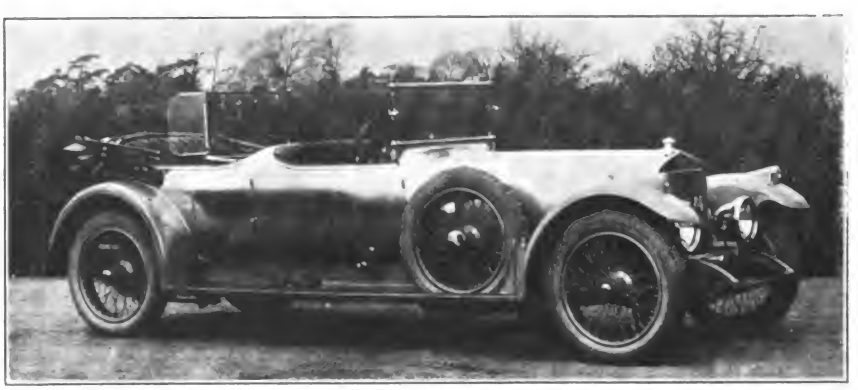

Fig. 1—General appearance of Lanchester 40 horsepower cars, the body being a typical British metal construction

To return to the details of the present 40 horsepower Lanchester model, the engine has its six cylinders of cast iron with integrally cast heads, arranged in blocks of three. The overhead valves are arranged at a slight angle from the vertical, the exhaust having its seat in the upper part of the combustion chamber, while the inlet is arranged in a detachable cage with a ground conical seat in the cylinder head. The exhaust valve is removed by taking away the inlet in its cage and drawing it through the hole. The valve heads are of the tulip pattern and the stems operate in phosphor bronze guides. This may be noted in Fig. 2, A and B.

The overhead camshaft is driven by a vertical shaft and helical gears from the crankshaft, the valves being operated

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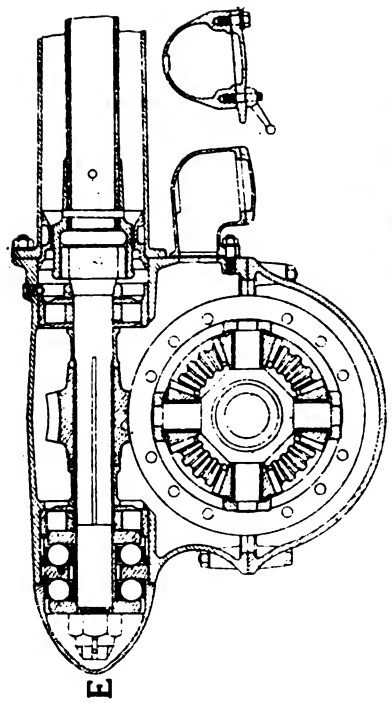
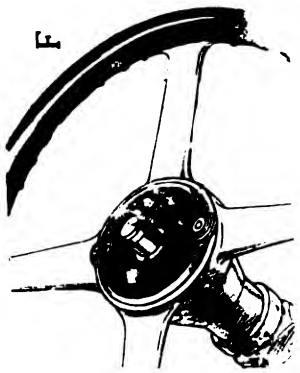
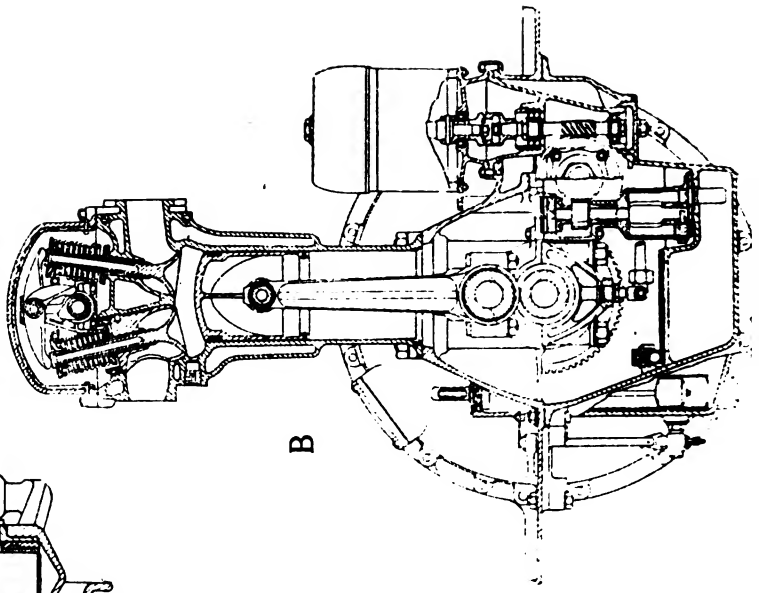






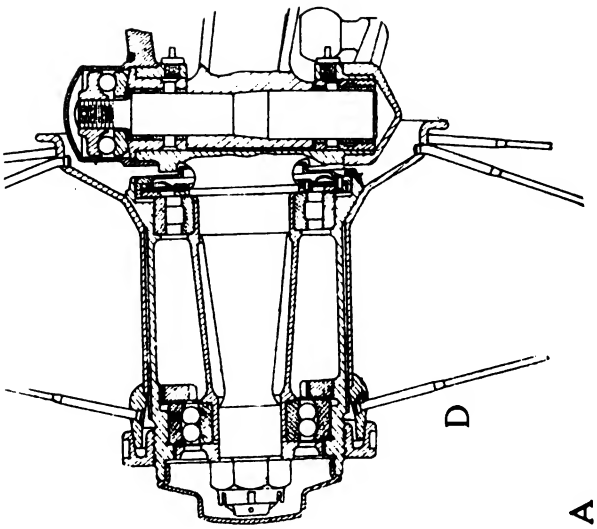
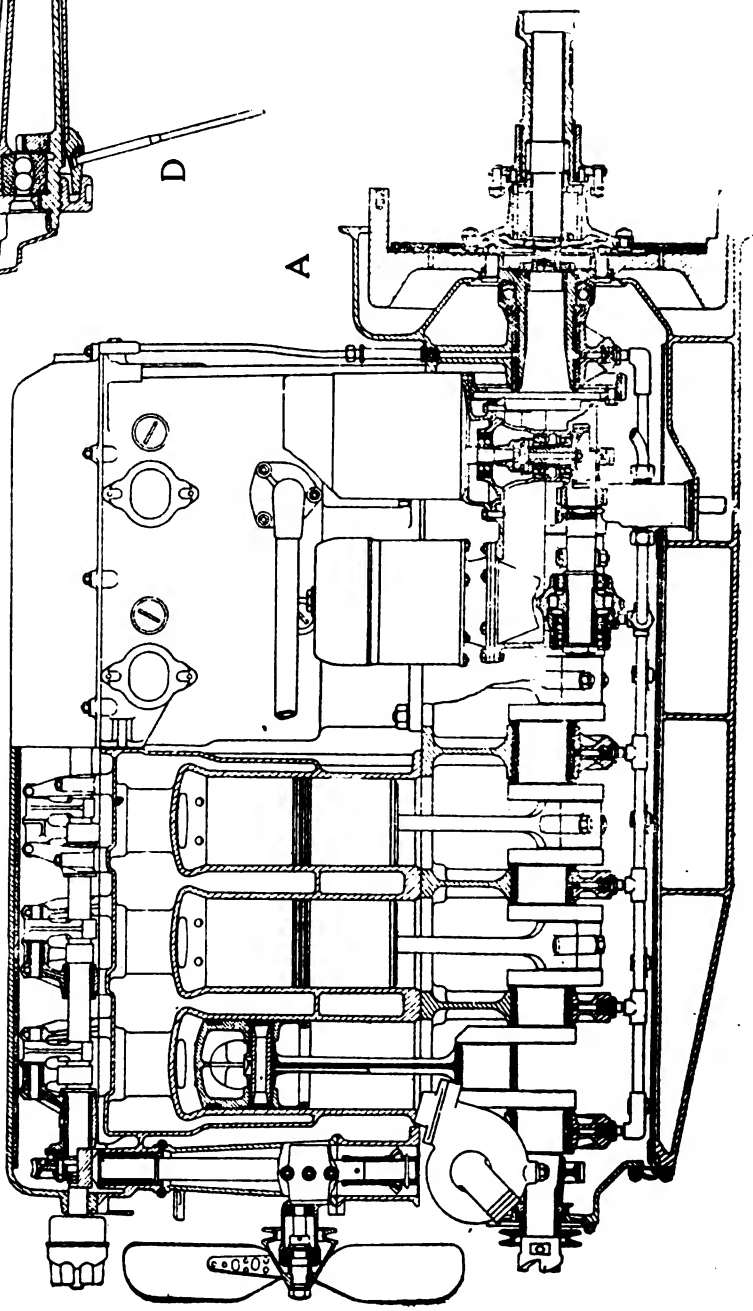
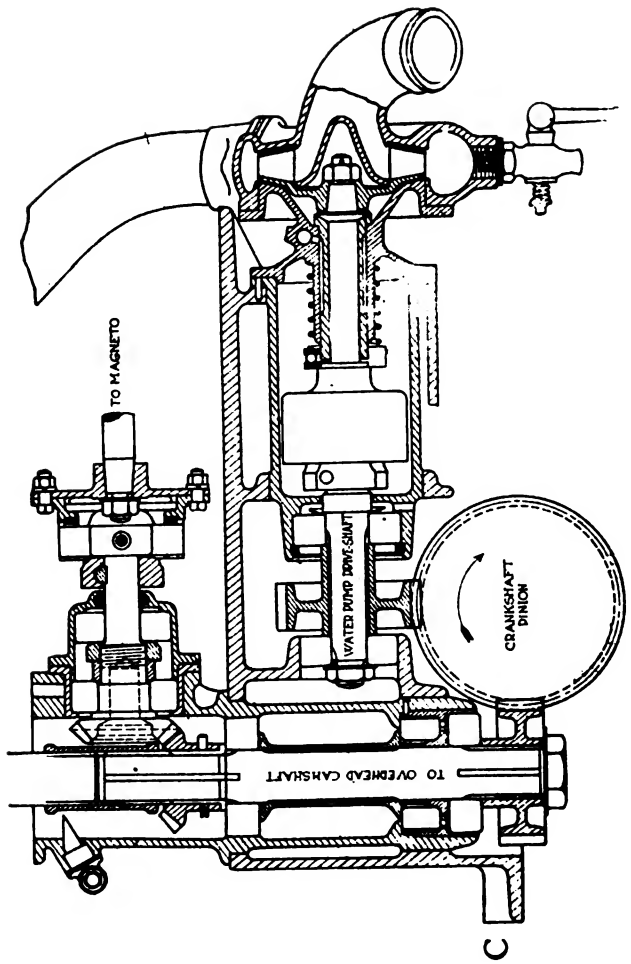


Fig. 2—Working drawings of Lanchester chassis parts. A, longitudinal section of motor. B, cross section of motor. C, detail of auxiliary driving shafts. D, front hub and wire wheel. E, worm gear and rear axle section. F, steering wheel and finger levers





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through rocking levers. Lubrication of the overhead valve-gear is assured by carrying a lead from the gear type oil pump to one end of the hollow camshaft, the oil finding exit through small holes to the cams, camshaft bearings and rocker bearings, the rocker levers being pivoted on a hollow shaft. Surplus oil runs back into the crankcase after flooding a trough in which runs the larger of the topmost pair of helical gears.

Two transverse distribution shafts are located at the front of the engine, one being driven by helical gearing and serving to drive the centrifugal water pump through a spring coupling; the other driving the magneto through bevel gearing, as shown in Fig. 2, C. A Remy ignition system is also provided, the distributor being mounted at the front end of the camshaft.

H-section connecting rods are used, with die-cast aluminum pistons having four rings. The hollow wristpin floats in phosphor bronze bushes in the piston bosses, being prevented from moving laterally by a split coned disc expanded into annular grooves in the piston bosses. The white metal liners are cast directly into the steel of the connecting rod big-ends, while the drilled crankshaft is supported from the top half of the aluminum crankcase in seven white metal lined bearings, the caps of which are of die-cast aluminum. Running parallel with the crank shaft, toward the rear end of the engine, is a layshaft driven by or driving the crankshaft through straight-toothed gearing. This layshaft serves three purposes: (1) To drive the oil pump by helical gearing; (2) to rotate the lighting dynamo, and (3) to form the driveshaft for the separate starting motor. The helical gear pinion on the motor shaft has a free wheel or overrunning clutch so that the motor armature is stationary except when engine starting is in progress. An unusual feature of the lighting dynamo and the motor is that they are mounted with their shafts vertical, the idea being to save space, while it also renders the brushes slightly more accessible.

Engine lubrication is maintained by the gear pump delivering oil through a gallery to the main crankshaft bearings and through the drilled crankshaft to the big-ends. This is one of the very few British engines having a direct feed to the wrist pins, tubes being attached to the connecting rods and running from the big-ends forward. A large oil filter tray covers the whole of the sump, and can be withdrawn for cleaning purposes from beneath the radiator without disturbing any other part.

Lanchester Motor Co. cars have always been fitted with planetary gearing and the new model forms no exception, the gearset providing three speeds forward and a reverse. A clutch pedal and gear lever, the latter on the right, are provided, and the operation of changing gear is carried out as in cars with the usual selector type transmission. The clutch is of the single plate type and is contained within the transmission casing, which also embodies its own oil pump with direct feeds to the main bearings. The high gear is a direct drive, while the usual brake mechanism obtains for the other gears, the means of adjustment for the bands passing through the casing to external thumbscrews.

At the rear of the gearset is an internal expanding type brake with a ribbed drum, behind this again being the casing of the propeller shaft universal joint. This casing is bolted to a deep cross member of the frame and supports the spherical head of the torque tube.

The Lanchester type worm lies below the back axle, which is of the full floating type, despite the favor with which the semi-floating axle was viewed by the Lanchester company before the war. The rear axle bearings consist of parallel rollers and a ball thrust at each side of the differential, while the wheels run on a double ball-bearing and one of the parallel roller type. A cross section, Fig. 2, E, shows this.

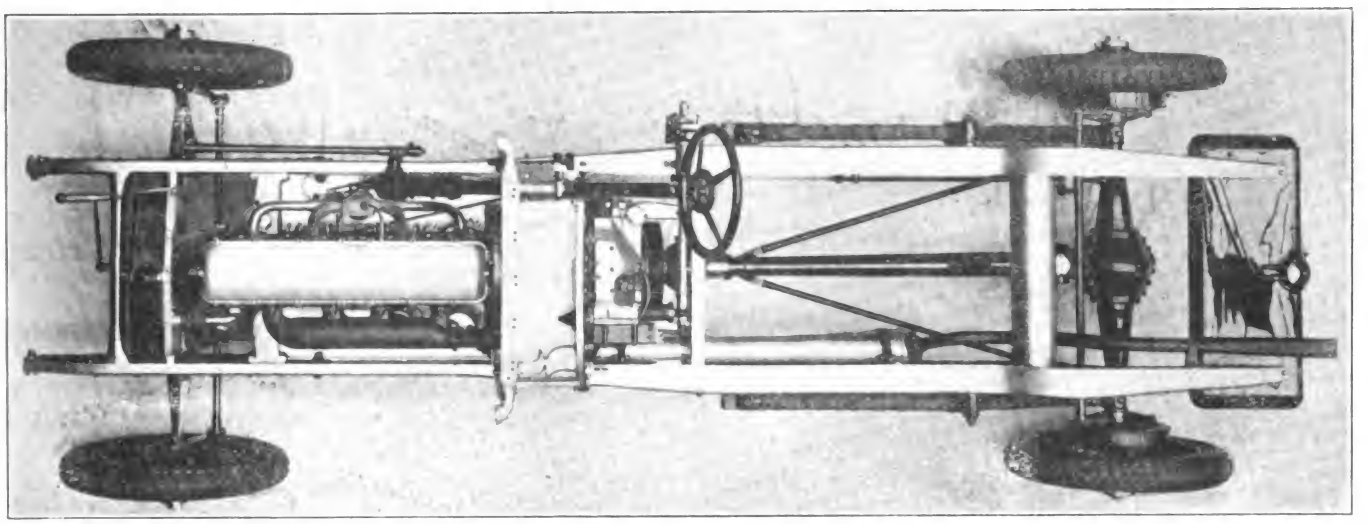

Fig. 3—Plan view of Lanchester 40 horsepower, six-cylinder chassis

Steel pressings are used for the torque tube and also for the differential casing and axle tubes. The outer ends of the driving axle have teeth formed on them to engage with serrations in the hub shell, the joint being pulled up onto a taper and secured by a nut and locking ring. Expanding brakes occur at the rear, where the suspension is of the cantilever type, the rear end of each spring resting in a housing between roller bearings. To take up lateral wear and prevent rattle, the rollers and the spring end are held up against the outer face of the housing by a volute spring. The roller housings are fed with lubricant directly from the rear axle.

The main frame of the chassis is, as usual, of pressed steel. A reversed channel liner, bored with large holes to reduce weight, extends inside the main channel from

(Concluded on page 30)

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Modern Tendencies in Engine Design*

By L. H. POMEROY†

Improvements in Engine Balancing and How Accomplished, Obtaining a Uniform Torque, Fuel and Carburetion, Chief Troubles with Present-Day Low-Grade Fuels

THIS aspect of engine design (improvement in balancing) would more properly be termed improvement in means for reducing engine vibration, since vibration is by no means eliminated when complete balance is obtained, a fact well known to most designers of six-cylinder and even twelve-cylinder engines.

In respect to engine balance per se, the position to date is that engines with two, four, six, eight or twelve cylinders, are or can be completely balanced in respect to primary and secondary unbalanced forces and couples. The six and twelve-cylinder engines are, of course, inherently balanced; the four and eight-cylinder need the application of a device for neutralizing the secondary unbalanced forces. Fig. 11 shows the Lanchester anti-vibrator, and Fig. 12 the Ricardo secondary balancing device, each of which is effective. The principle of the Lanchester device is that of two reverse-rotating bob weights that apply equal and opposite forces to the secondary inertia forces set up by pistons at the end of each stroke, the bob weights rotating at twice the engine speed. As the energy content of the bob weight system is constant at a constant speed, the only force required to drive the device is that arising from the friction of the bob weight spindles, so that the driving mechanism is merely a motion transmitter. When the engine is accelerated or decelerated, tooth pressures of material magnitude arise, but can be dealt with easily. The peripheral speeds of the gears is 90 ft. per second at an engine speed of 3,000 r.p.m., approximately the same as with many turbine reduction gears in daily use where, in addition, the tooth pressures are exceedingly high.

The Ricardo device is based upon the principle of introducing reciprocating masses driven by linkages, producing the same angular effects in respect to inertia with these masses as the connecting rod crank system produces with the pistons. It is exceedingly ingenious. The conditions under which the pin joints in the linkage systems work are no worse than those of the piston pin, and although the device appears a little complicated, it is simple in detail and works well. It has not, however, the advantage of ready application to existing designs possessed by the Lanchester anti-vibrator. I have corresponded with many people on the subject of secondary balancing and have found a general vagueness of thought thereon, many confusing secondary balancing with crankshaft torsional damping and still more stating that they had attained the same ends by crankshaft counterbalance weights. Whatever effect counterbalancing may have in reducing bearing loads, it certainly does not, per se, affect the balancing problem one way or the other. The only virtue of crankshaft counterbalancing, the addition of balance weights to the crank webs so that each individual crank and attached rotating masses may be balanced, is that wear on the middle main bearing of the crankcase can thus be practically eliminated and the crankcase itself reduced in weight very considerably.

The whipping tendency or "skipping rope action" of an unbalanced crankshaft, particularly in a six-cylinder engine, sets up very heavy bearing loads and crankcase stresses, so that counterbalancing may be very desirable in engines with center crankshaft bearings. The elimination of the center bearing, another accepted fetish, dodges the bearing loading problem very well, and will doubtless be more widely adopted than at present. Further, the use of counterbalance weights should be accompanied by an increase in crankshaft diameter, owing to the torsional mass effects of the balance weights which may easily exemplify the adage that the cure is often worse than the disease.

Chief Factors in Vibration

Apart from the question of structural rigidity, recipro-

*Continued from page 10, February issue. This is part three.
†Consulting engineer, Cleveland, O.

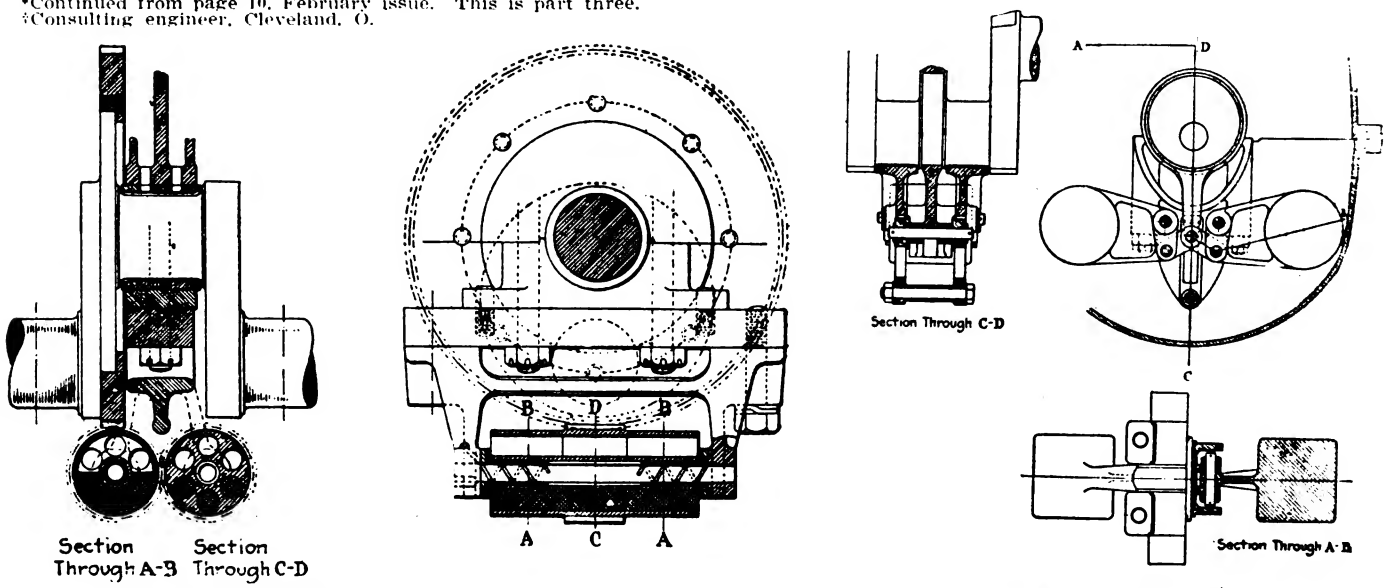

Fig. 11—Sketch showing construction and working action of Lanchester antivibator. Fig. 12—The Ricardo secondary balancing device

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cating mass effects present no serious problems nowadays, irrespective of number of cylinders and crank disposition. The question of vibration can therefore be studied in the light of how far it is necessary or desirable to increase the number of cylinders in order to satisfy the legitimate demand for smoothness and flexibility of running. From this viewpoint the chief factors are:

1. Uniformity of torque.
2. Torque reaction.
3. Inertia torque variations.

Uniformity of torque is a matter of number of cylinders on the one hand and flywheel weight on the other. By flywheel weight here is included the whole mass of the car in the automobile application of gasoline engine. In other applications the choice between increasing the number of cylinders on the one hand or the weight of the flywheel on the other, would be a matter for purely individual taste, if the problem had no other aspect. In either instance sufficient torque uniformity can be obtained to satisfy the most exigent case.

The question of torque reaction is not disposed of so easily. It is in respect to the reactive effects upon the crankcase supports, caused by the fluid pressure in the cylinders, that 75 per cent of the argument lies in the choice of the desirable number of cylinders, particularly for automobile use. In a discussion of this kind the point that the purchaser wants a six, an eight or perchance a twelve-cylinder car and therefore must be so supplied is quite irrelevant except insofar as it calls for an analysis of the situation in general. Whatever the reason for the public taste with regard to multi-cylinder engines, whether it be actuated by advertising or genuine need, the outstanding fact is that the multi-cylinder engine has a large following, and therefore gives the purchaser something which appeals to his sense of comfort and fitness.

It is the business of engineers to translate the often inarticulate but nevertheless real desires of the user into mechanical terms, and to consider how design can be improved without demanding any sacrifice from the user regarding the standard of performance with which he is satisfied. Whether the result, in gasoline engine design, is an engine with 50 cylinders or none at all, is of little importance. The ultimate test of sales indicates as frequently as not that, given equal performance, a new article cleverly advertised will scare the sales departments of competitors into demanding novelty even at the expense of proved worth and reliability. And of this it would be difficult to find a better example than that displayed in the history of the eight-cylinder car in America and the six-cylinder car in Europe.

With these remarks I would submit that torque reaction is one of the chief problems before engine designers today. The combination of low-gear ratios and large multi-cylinder engines, which have occurred simultaneously, entirely masks the problem from the viewpoint of performance. The "feeling" of a four-cylinder light low-geared car in respect to acceleration and flexibility is practically indistinguishable from that of an eight-cylinder car of the same gear ratio and capacity per cylinder but twice the weight. In a previous contribution this aspect of the case has been dealt with in some detail, and all that would seem pertinent here is to urge again that automobile engine design is but one phase of the much larger problem of car design. If in reference to acceleration, slow running, capacity for high-gear work, and, last but by no means least, absence of apparent torque reaction, it can be shown to be reasonable that the attainment of an accepted standard is primarily a function of car weight, the number of cylinders which will fill the conditions reduces itself to a matter of simple arithmetic.

It is quite conceivable that the four- and the eight-cylinder engines may win out, each in their respective spheres. They are natural relations and between them they can certainly fill any existing demand. Unfortunately the eight-cylinder engine as now designed is very wide and precludes in some cases an artistic hood and radiator design. But this is by no means inherent in the type, as a later section of the paper will indicate. Briefly, the case for appearance in relation to the eight-cylinder engine rests upon the short-stroke engine with short connecting rods and secondary balancing, and an "eight" designed from this viewpoint should present many attractive features.

Piston Inertia

In the list of the factors contributing to vibration disturbance, mention was made of the torque variations due to piston inertia. This subject is but little appreciated and a few words may be of interest. This torque variation arises from the fact that the pistons are brought to rest twice per revolution, thus causing alternating tension and compression forces in the connecting rod. The horizontal component of these forces evidently tends to rotate the crankcase about the crankshaft axis and causes a variable torque reaction upon the crankcase supports. Under certain conditions these reactions are neutralized by the fluid pressure in the cylinder. A little thought will show that if at the latter part of the compression stroke the connecting rod is in tension due to piston inertia, this tension can be neutralized, or in fact altered to compression, by the fluid pressure upon the piston due to compression. Under these circumstances the torque reaction due to fluid and inertia pressure will be zero. There is clearly a field of engine speed and compression pressure in which the compression will largely neutralize the torque variation due to inertia.

As the compression pressure may be considered constant with an increase of speed and the inertia effects vary as the square of the speed, it is obvious that the inertia effects will start by being less than the compression effects and gradually eclipse and finally exceed these. This inertia torque variation is often unpleasantly manifested when the throttle is suddenly closed at high speeds, and the cushioning effect of the fluid pressure removed. Many engines then behave as if a bag of nails had been introduced into the crankcase, and at least one patent has been filed relating to carbureters in which the supply of gasoline but not air is cut off when the throttle is suddenly closed. The fundamental remedy is to neutralize the inertia effects at the source.

(To be continued)

Taxicab Service Organized in Singapore

The universality of the motor vehicle is well shown by the news from the Far East that a taxicab company has been organized in Singapore, Straits Settlements, to provide the city with an up-to-date transportation system Finances for the undertaking, it is reported, will be derived from the sale of 35,000 shares of stock at $10 each. The equipment will include 40 landaulet taxicabs, five one-ton trucks and five lorries.

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New Engines and Speed Craft at Motorboat Show

At the annual motorboat show, held in Grand Central Palace, New York, from February 21 to 28, inclusive, the outstanding features were the number of new motors shown, and the speed craft. The latter, of course, attracted the greatest amount of attention from the crowds present, but the former as a matter of fact, indicated a greater amount of engineering and business advance. There were a surprising number of new engines, these too, in a variety of new type, and modifications of old types.

Thus, the Hall-Scott airplane engine was presented for the first time as a marine unit, mainly for speed boats and similar uses in which the price would be secondary. The Knox overhead valve motor, originally developed for the Knox line of heavy trucks, was also presented as a marine unit. Of the out and out new motors, J. V. B., DuPont, Murray & Tregurtha, Palmer, Mianus, and Fairbanks-Morse. The J. V. B. is named after Joseph Van Blerck formerly designer of the Van Blerck line of heavy marine motors, and is the product of a new Akron, O., company. The DuPont is an overhead valve type with complete enclosure, made in two and four cylinders. Murray & Tregurtha, old time builders of heavy engines, has been reorganized and has placed on the market a new light weight high grade high priced engine along Liberty engine lines, in two sizes, both sixes. Palmer has some new bigger units, and Mianus, a new heavy-oil engine in a complete range of sizes. The Fairbanks-Morse is a high powered heavy oil engine along semi-Diesel lines.

Miss America, one of the boats expected to compete for America in the Harmsworth trophy races this summer, was displayed at the show as a 70-mile boat. At the same time its exhibitor, Chris Smith, of Algonac, stated that he is building two other boats both guaranteed to exceed 70, and one to exceed 75. Miss America measures 22 ft., but the new boats will be longer, one between 30 and 40, and the other 32 ft.

The Society of Automotive Engineers held a motorboat session during the week, at which Present Day Requirements of Motors, Diesel Engines, and Piston Performance were some of the topics treated.

Aircraft Show Indicated Much Progress

The annual airplane show was held in New York February 6 to 13, the 71st Regiment Armory at 34th street and Fourth avenue being used in place of Madison Square Garden as in previous years. The show was not a large one, and the number of accessory exhibitors was particularly small, so that the smaller space of the armory gave an intimate, cosy appearance which was lacking previously, besides housing the aircraft shown in an adequate manner.

The range of exhibits was from an aerial flivver to the giant mail planes, and included a good-sized blimp. The little machine was the L. W. F. Butterfly, practically the same as the machine described in the last issue of The Automotive Manufacturer under the name of the Cato Sport plane. It has a wing spread of but 29 ft. and weighs but 600 lbs. The big planes were the Thomas-Morse mail plane with three separate fuselages and two big engines, and the Curtiss ten-passenger two-engined Eagle.

Other interesting exhibits were those of the Packard company's line of airplane engines, including a 12 and an 8, and the new device called the fuelizer said to supply the right quantity of fuel regardless of altitude or temperature conditions, the Curtiss exhibits of wind tunnel and engines, the flying boats, aerial coupes, and the Goodyear blimp.

One of the largest and most successful meetings ever held by the Society of Automotive Engineers, aside from annual meetings, was held in the middle of the week for the aerial men. This included a technical session in the afternoon, with papers and motion pictures, and a reception and dinner in the evening.

The afternoon session was opened with a paper by Col. V. E. Clark on Possible Airplane Performance with Maintenance of Engine Power at All Altitudes. Possibly one of the most interesting talks of the day was that of Grover C. Loening on The 200 Miles Per Hour Airplane, in which Loening pointed out that engineers were in error in seeking for light weight per horsepower in aircraft engine. The fundamental to be followed, he maintains, is rather "low head resistance." Other speakers were: Alexander Klemin on possible methods of braking a plane to enable use of smaller landing fields; S. R. Parsons, Some Factors in Design of Airplane Radiators; Archibald Black, on Heat Treating of Brazed Fittings for Aircraft; S. W. Sparrow, Flying an Aviation Engine on the Ground, pertaining to methods of testing airplane engines. The afternoon was concluded with a report by Chairman H M. Crane, of the aeronautical division of the standards committee, S. A. E., in which the program of that division for the coming year was outlined.

A reception preceded the banquet at the Astor in the evening. J. G. Vincent, president of the S. A. E., who presided, spoke of the past and present features of engineering the society was interested in. He mentioned the increase in membership and divulged his forecast of the future of the organization. Glenn L. Martin acted as toastmaster. Maj.-Gen. C. T. Menoher, director of the Air Service, U. S. A., was the principal speaker. He declared it was true "that the air service was below the limit of efficient service in both officers and enlisted personnel," putting the blame for this condition on Congress. Com. G. C. Westervelt, U. S. N., spoke on naval airplanes and air policies of the navy. He was followed by Commodore Charleton, of the British Navy, who discussed the advisability of uniting army and navy air service under one head, as in England.

Production of the Principal Metals of the World

Dr. J. B. Umpleby, of the U. S. G. S., in a lecture given in Paris, France, stated that during 1913 the United States produced 39 per cent of the world's coal, 36 per cent iron 56 per cent copper, 32 per cent zinc, 30 per cent silver 17 per cent tungsten, 38 per cent molybdenum, 65 per cent oil, 95 per cent natural gas, 16 per cent arsenic, 48 per cent phosphates and 20 per cent salt. During the same year the Transvaal produced 41 per cent of the total gold, Russia 99 per cent of the platinum and 55 per cent of the manganese, Peru 76 per cent of the vanadium, Rhodesia 35 per cent of the chrome iron ore, Canada 85 per cent of the nickel, China 53 per cent of the arsenic, India 59 per cent of the mica, Spain 54 per cent of the pyrites and 31 per cent of the mercury, Italy 43 per cent of the sulphur Germany 92 per cent of the potash, Chile 22 per cent of the nitrate, France 58 per cent of the bauxite, Malay Peninsula 40 per cent of the tin, Austria 74 per cent of the magnesite.

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Serious Fuel Situation in British Isles

An insight into what the near future may bring, in the matter of fuel for automotive engines, either in the way of prices for present-day fuels or possible substitutions or modifications, may be gained from the recent report transmitted by Consul Claiborne from London, Eng., under a very recent date. He stated that the announcement that an advance of 14 cents a gallon on the present price of gasoline will become effective within the next 10 days has caused further attention to the much discussed difficulties of supply and price, especially in view of the fact that the present retail price of gasoline is 74 cents and the contemplated increase will raise the figure to 88 cents per gallon. The immediate effect will be to increase the costs of operation to the private motorist by two-thirds of a cent a mile. According to the London Times the estimated consumption of gasoline in the United Kingdom for 1920 will be 240,000,000 gallons, and therefore the increase of 14 cents will increase the gross revenue of the oil companies by $33,600,000.

There appear to be numerous concomitants responsible in varying degrees for the present situation, prominent among which are the rates of exchange, from both America and the Far East, high freight rates, scarcity of tankers, the increased use of gasoline due to the multiplication of automobiles, and the advent of gasoline-consuming airplane motors.

Consumption Outstripping Production

Although the shortage of tankers is an immediate and pressing problem, British opinion is firm in the belief that American and British shipbuilding will rectify the shortage by midsummer. The ultimate difficulty is that the world's production of oil is not increasing as fast as is the demand. British statisticians estimate that the world's demand for gasoline is "at the rate not below an average monthly increment of 70,000,000 gallons.

Governmental control, ownership, or operation in some form is often suggested as a salutary measure to prevent exploitation of the oil deposits of the British Empire at the expense of the consumer. However, the recurring and central difficulty is the actual and progressively increasing shortage of supplies, only to be overcome by the discovery of new fields, the increased production in and better distribution from existing fields, and the substitution of other liquid fuels for gasoline.

Substitution for Gasoline

During the war the science of substitution reached its zenith. Owing to the great consumption of gasoline in the army, navy and flying corps, and the difficulties of marine transport, the supplies of motor fuel allocated to civilian automobile owners became almost nil, a situation which led to a great development in other liquid fuels. Benzol has proved satisfactory as a motor fuel, especially when diluted with other liquid fuels. In the event all gas companies are compelled to debenzolize their gas, it is estimated that from 12 to 17 per cent of the motor fuel consumed in the United Kingdom could be furnished.

An interdepartmental committee reported last June that the development of power alcohol was feasible and desirable. Power alcohol has already been made by the synthetic conversion of ethylene after its separation from coke-oven gases. It is also believed that British distillers, with their scientific knowledge of the manufacture of alsoholic beverages, can manufacture power alcohol as well as potable alcohol. A recent article asserts that alcohol (95 per cent by volume) can be made on a large scale at the distilleries at 36 cents per imperial gallon. If no benzol is available to mix with it, the necessary proportion can be converted into ether—at a further cost approximating two cents a gallon. Such fuel was used in South Africa during the war and is said to work well in an ordinary gasoline engine in the ratio of six gallons for five gallons of gasoline in the same work or energy generated. With a higher compression in the engine equal efficiency in miles per gallon is claimed.

Coal gas was used extensively in the war in large baglike containers, usually carried on the top of the automobile, and the possibilities of traction by compressed coal gas carried in cylinders is a possible alternative to gasoline when the price becomes unduly high.

British Oil Companies' Profits

Figures published in the London press indicate that in 1919 the oil companies all made very considerable profits. Shell, one of the largest companies declared dividends of 35 per cent, set aside over $5,000,000 to surplus, and later issued additional shares of stock. Mexican Eagle made more than $37,000,000 Mexican and declared dividends of 45 per cent. Anglo-American paid $1.47 a share and stock dividends. Anglo-Persian made almost $10,000,000 (compared with $1,700,000 in 1917) and declared dividends of 10 per cent. Burham declared 30 per cent in cash and some stock dividends.

Leather and Leather Substitutes

Hide leather has been very successfully imitated in so far as appearance goes. The substitutes are available in all the standard leather grains and colors. For furniture and automobile upholstery, shoe trimmings, bookbinding, hat sweats, traveling goods, etc., they have proven economical and practical conservators of genuine leather, but for such uses as shoe vamps and harness a material is required that will stand continuous flexing and bending.

Recently there has been a tendency to turn from land animals to denizens of the briny deep in the search of leather. Fifteen dollar shoes is the main reason. The hides of whales, sharks and dog fish are being experimented with.

Leather substitutes are not without their advantages even over real leather. First, they are cheaper; they are waterproof and they cut up into desired shapes and sizes much more readily than leather and without the waste that always occurs when cutting hides.

An automobile seat becomes wet. If it is made of leather substitute it can be quickly wiped dry. Not so leather, for the water has penertated through the surface. The rider sits on a wet seat the rest of his trip.

A handy steel heat-treatment chart on heavy cardboard is being sent out by the W. S. Rockwell Co., New York. The reverse side carries data on specific heat and melting points, and much other useful information.

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Increased Speed in Molding Automobile Parts*

Remarkable Foundry Efficiency Has Been Produced by Co-ordination of Processes Similar to That Which Governs Machining and Assembling Cars

By D. M. AVEY

THE fact that motor cars and other automotive vehicles are machined and assembled with a neatness and despatch which is far above and beyond that used in the machining and assembling of other machines is now pretty generally admitted. But the lessons of progressive manufacture and quantity production are rapidly being learned in other fields of endeavor and are being applied to them with beneficial results. Particularly is this so of those like automotive foundries, coach builders, and similar lines of work which are so close to the actual car constructors as to be in constant touch with their methods, in fact so slosely allied as to be effected by the press for greater and greater production.

Castings, forgings and rolled metal products all enter largely into the automobile, but the most fundamental parts are, and have been, castings since the earliest conception of the horseless carriage. Cylinders, whether individual or enbloc are gray iron or semisteel castings except in a few cases. Transmission and differential housings are cast from iron or steel. Aluminum, steel or iron castings form the pistons and crank cases. Aluminum, brass or iron castings enter into carbureter and ignition parts and the numerous small pieces which are used for mountings and fittings about the chassis and body of an automobile. Heavier machines, such as freight handling trucks, tractors and farm power units in many cases use steel frames, wheels, drive sprockets and special supports.

*Reproduced from The Foundry, Cleveland, O., by special editorial arrangement.

Applied foundry knowledge has made possible the production of all these vital parts, and in turning them out foundrymen have been led to devise methods of molding, casting and alloying metals which might have remained unknown had not the impetus of the automobile industry furnished the necessary encouragement.

Automobile cylinders have formed the basis of study since the early days of manufacture. Multicylinder engines introduced problems in molding and in metallurgy which have become more and more complicated with each advance in automobile design.

The earlier types of cylinders depended upon copper jackets for circulating the cooling water which absorbs the heat developed in firing. It was thought that a complicated casting which would include the water jacket with the cylinder block would develop stresses in cooling which later would result in failure. This theory gave way before practical experience and water-jacketed cylinders are now cast in huge quantities.

Earlier types of cylinder blocks which carried the water jacket as an integral part were exceptionally heavy and unnecessarily thick in section. Modern ideas, however, soon contributed a casting which became practically a standard for four-cylinder engines. This type has been varied only in minor details to conform to the valve-in-the-head, T-head or L-head designs. With the fundamental questions of design satisfactorily disposed of, foundries during the past few years have been mainly concerned with production. The swift pace set in machining and assembling

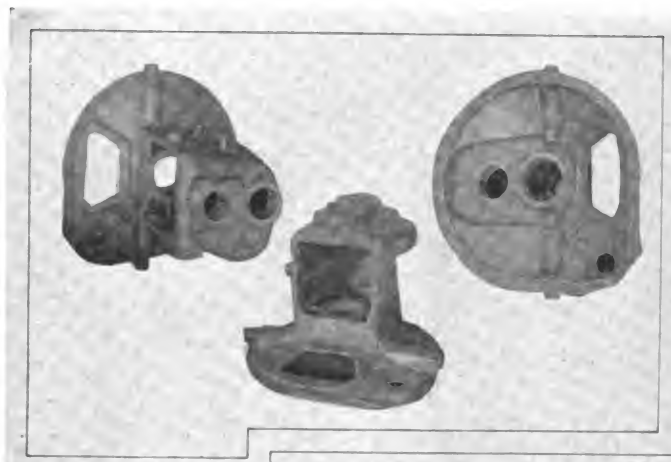

Fig. 1, Above Left—Three views of transmission housing of intricate form

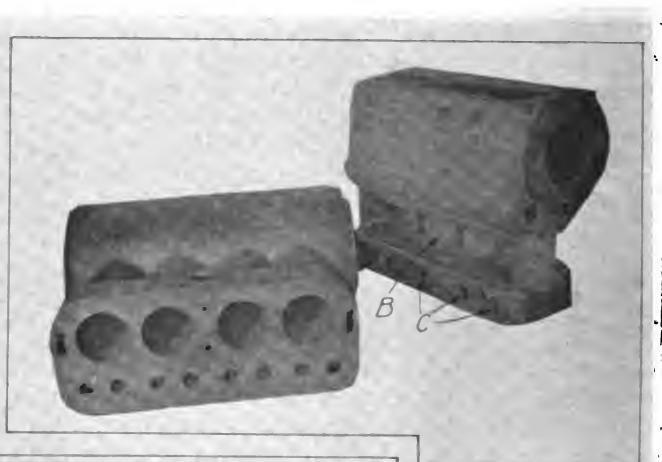

Fig. 2, Above Right—Cylinder and crank case block for four-cylinder engine

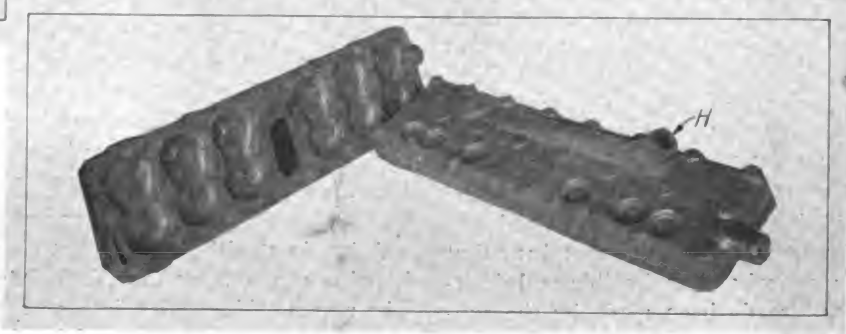

Fig. 3—Cylinder head for six-cylinder automobile engine

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by the large automobile factories has been closely followed by the foundries. Shops handling this class of work are perhaps the most advanced in rapid and accurate molding methods and economical production.

The American Foundry Co., Indianapolis, specializes largely on automobile castings, and has developed and applied extremely rapid methods to the molding of cylinder and crankcase blocks, transmission housings and cylinder heads.

A common type of cylinder and crankcase which is made in quantity by this company is shown in Fig. 2. This is an L-head design, provided with a water jacket around the upper portion of the cylinders to match with a water-jacketed head which is a separate casting. In making this job, the American Foundry Co. makes use of a special flask and molds the cylinder block upon its side. The rig for this job is shown in Fig. 4. Two molding machines made by the International Molding Machine Co., Chicago, are used; one making the cope while the other produces the drag. With these two machines a gang of eight men makes and pours from 125 to 140 molds per day. A record of 22 molds an hour has been made.

One man from the molding machine gang cleans the pattern, sets the flask and drops in the facing sand while the other is slicking and cleaning the previous mold which has just been made. Both men then concentrate on throwing in the remainder of the sand required. The mold is next jar-rammed on the machine and turned over and the pattern is drawn by hand. The mold is finished and patched where needed and the carryaway gang of two men takes it from the machine to the floor.

The drags are clamped upon liberally vented steel bottom boards before they are rolled over. The handles on opposite corners of the flask are engaged by a rope sling, and the drag and bottom-board together are raised from the machine and carried to the molding floor by an overhead air hoist. Special trunnions are provided on the cope flasks to enable them to be easily lifted and turned over; these may be noted at A in Fig. 4. These trunnions are engaged by a special rig; the application of lifting force in the center of this rod at the point where the crane hook is engaged causes the two ends inserted in the flask trunnions to pull toward each other, holding the flask firmly, but allowing free rotations upon the axis of the ends of the bar.

As may be noted, the flasks have a series of four semi-circular recesses in the edge of one side and a rectangular slot in the opposite edge. These serve to support the two ends of the main cylinder and crankcase core which is made and set in place in two halves.

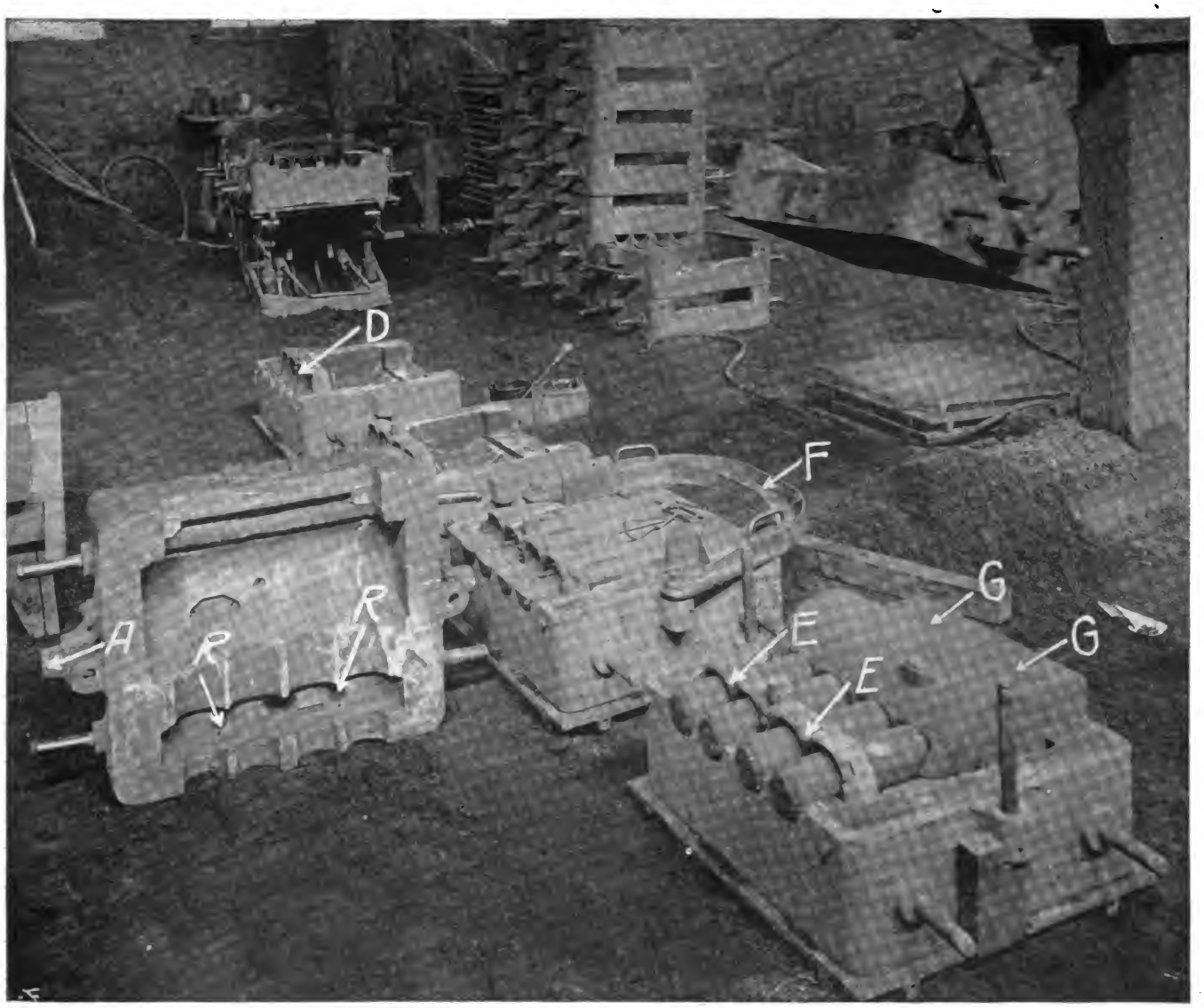

Fig. 4—Layout for molding the cylinders shown in Fig. 2—the machine used for molding the drags is in the background

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Fig. 5—Port core machine showing the completed core on the table of the machine at the right

Fig. 6—Method of molding three saddle cores at once

Although the cylinder molding method used in this shop is essentially green-sand work, a liberal number of cores are used. Two men set the cores and prepare the molds for closing. When the drag half of the mold is set on the floor the saddle core is placed. This is essentially a lightening core, but it forms the recess at B, Fig. 2. In this recess the springs which actuate the valves in the finished motor are made accessible for repairs and replacements. A core is used to form this part of the casting as the sharp angles would be subject to breakage in green sand, and any attempts at patching might lead to bubbling and defects when the mold is poured.

The bottom half of the water-jacket core, or port core as it is called, is set in position next. This is shown on the coremaking machine in Fig. 6. The port core is supported by five core prints at the points C illustrated in Fig. 2, while the eight valve ports are formed by the vertical bosses shown in the completed core resting upon the table of the machine in Fig. 5.

The upper half of the water-jacket core is placed upon this port core as shown at D, Fig. 4. This forms the hollow necessary to give thickness to the walls of the water jacket and small dowels make the openings in the upper surface by which the water passes from the jacket surrounding the cylinder to the hollow cylinder head. Small pieces of tin are placed in the recesses shown at E to form a bearing for chaplets which brace the core firmly against the cope when the mold is closed. This prevents the core from floating and takes some of the upward pressure which otherwise would be resisted by the center print alone. This print, which may be noted at the center of the port core, forms the opening at the side of the water jacket through which the cooling water enters.

Fig. 7—The machine used for molding the cores for the cylinder and crankcase casting

With the saddle, port and jacket cores in place, the lower half of the combined cylinder crankcase core is set. This is supported upon a lateral print which extends through the side of the flask at the base of the crankcase and upon the four cylinder barrels which are carried through and rest upon recesses in the opposite side of the flask. The position of the lower half of this core is determined accurately by the position of the shoulders in the drag portion of the mold. A special jig is used to locate the upper half of the cylinder crankcase core. This may be noted at F in Fig. 4. Two handles are set in the jig for convenience in lifting and setting it in place. Rigidly fixed pins which fit into the lugs at the ends of the flasks locate the jig accurately with reference to the imprint in the drag. The upper half of the cylinder crankcase core then is lowered carefully by means of the two hand hooks which engage the core arbors through small openings. The half cylinders are inserted under the jacket core, and the entire core then is shoved forward until the base or crankcase portion of the core reaches the small shoulder on the jig and slips into its position against the bottom half of the core already in the mold. The cope half of the mold is swung into position, located by removable flask pins set in the lugs on the drag and dropped into place. The protrudings ends of the cores are then luted with a mixture of molding sand and water, and the mold is ready for pouring.

The sand heap forms a basis about which the whole cylinder molding job is built. The two molding machines are mounted on wheel trucks and travel forward, one on each side of the sand pile. As the molds are completed they are swung into position in two or more rows just back of the machines so that at no time does the

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carryaway gang have to move more than 10 or 12 feet. Cores are delivered upon small elevated carrying platforms built at a convenient height to enable the core assemblers to reach and lift the cores directly to the molds. Bottom boards and flasks are neatly piled at points only a few steps from the paths of the molding machines. In fact every minute detail which contributes to speedy action is studied with care. The small detail of the trunnions which were found so serviceable on the cope flask is typical. A rope sling serves at present for the drags, but the trunnion rig will save time, so the expense is deemed warranted and allowed without question.

The metal is poured into a single gate connected to two runners through the two strainer cores in the top of the upper cylinder-crankcase core, shown at G, Fig. 4. Two liberal connecting runners pass down through the bottom half of the core, allowing the metal to reach the bottom of the mold first, pass thence around the cylinders, and water jackets. Two risers are set at the points marked R. illustration. The loose piece is drawn back immediately when the corebox is inverted, which permits the mold to be lifted free. A special plate which supports the five core prints at a slightly higher level than the rest of the core, is used to convey the core to the drying ovens. The jacket core is made in a manner similar to that used for the port core, but one man makes a sufficient number to supply all the molders on the floor.

The following sand mixture is used in making the cylinder cores. Fifty gallons of sand, 8 pints of a compound manufactured by the Werner G. Smith Co., Cleveland, and 3 pints of a binder made by the American Gum Products Co., New York. Eight core ovens provide capacity sufficient to handle all the cores needed in this foundry. All the cores are baked at night, five charges being made at intervals into coke-fired ovens. The cores are heated steadily for a half hour, they then are allowed to remain in the ovens for an additional 1½ hours and cool gradually before they are removed.

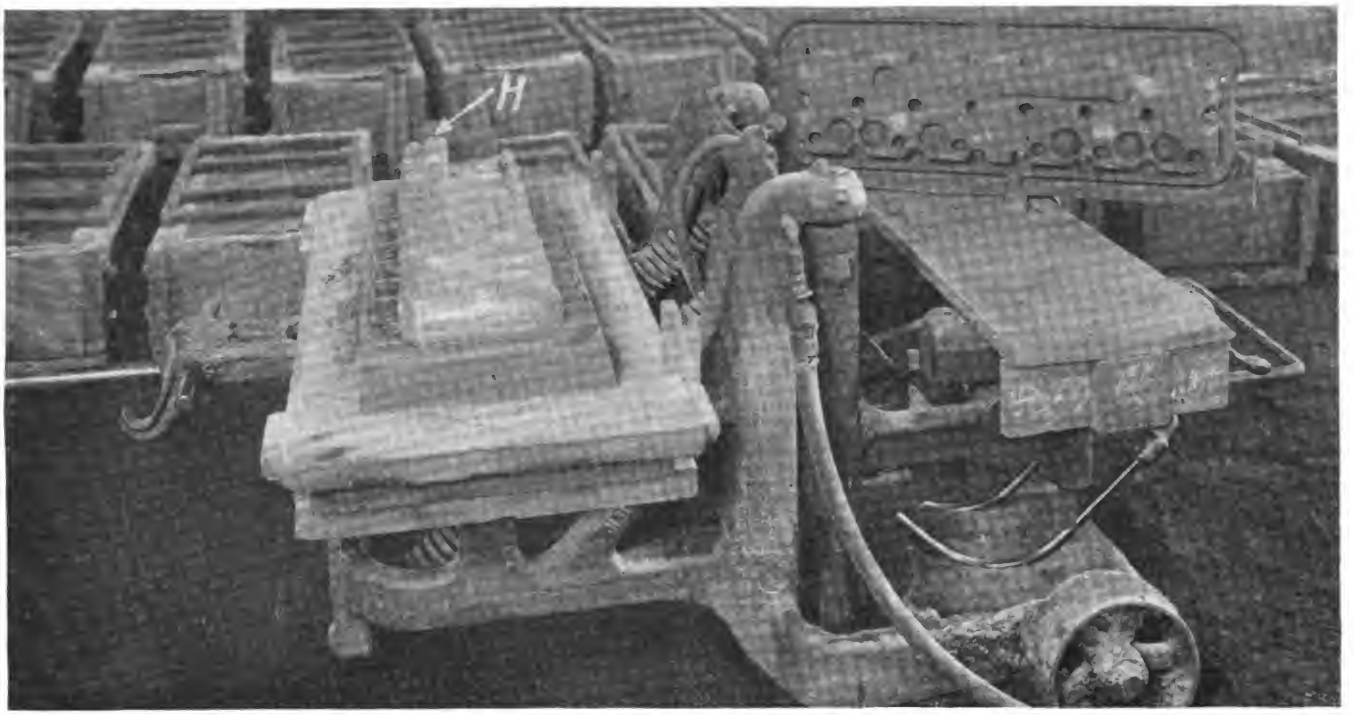

Fig. 8—Molding machine, inner and cover core for molding the cylinder head shown in Fig. 3. Note the closed and weighted molds in the background

All the cores on the cylinder job are machine made. The half-section cores forming the cylinders and crankcase portion of the casting are hard-rammed on the machine shown in Fig. 7. Four long bar arbors are placed in the heavy portion of the core and four L-shaped bars, placed in the center of the cylinder barrels, are bent into the crankcase portion of the core. Three men make 150 of these cores per day.

The saddle cores are made, three at a time, on the air-squeeze turn-over machine shown in Fig. 6. This was made by the International Molding Machine Co., Chicago. One man makes 200 saddle cores per day. These are liberally vented.

A hand roll-over machine, shown in Fig. 5, is used for the port core. One man operates this machine and with a night man makes all the cores of this type required. The average output is from 90 to 100 cores per day of nine hours. A loose piece is necessary in the box for this core. This is shown on the sand bench at the left of the

A cylinder head job which is handled by the American Foundry Co. again is typical of the methods pursued. This casting is shown in Fig. 3, and as may be noted, it is for a six-cylinder motor, differing only in minor details from the head which would be required for the cylinders just described. The head is molded with its upper surface down. This surface alone is molded in green sand. The water jacket space is formed by a core suspended from a second or cover core which serves a double purpose. The cover core forms the under surface of the casting and carries the water-jacket core suspended on wires fastened to the arbors of the two cores at several points. The green-sand drag is molded on an International roll-over machine operated by two men. The same men who operate the machine carry the molds and place them on the floor. A third workman sets the cover core with its suspended water-jacket core and places a rectangular weight across the mold resting upon the edges of the drag flask but lightly touching the cover core and supporting it

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against the upward thrust of the molten metal. The gang of three men makes on an average of 65 molds per day.

In molding the cylinder heads, a small core is placed to form the hollow and stop-off for the water outlet shown at H, in Fig. 2. A second core called a step core serves the double purpose of a ram-up core and a form for the boss shown at the forward end of the casting.

Similar in many ways to the general procedure employed in molding the cylinder crankcase casting, is that employed on a transmission housing job which the shop is making. However, a more elaborate rig is employed for the transmission molds, a floor of which is shown in Fig. 9. Special flasks trapezoidal in section are used. These require only a thin layer of sand to receive the impression of the pattern. This light thickness of sand is supported by cross bars which are cast integral with the flask. The bars or more properly webs adjoining the main flange section of the mold are cut in a semicircle to allow clearance for the cores. The light flask and small amount of sand used makes it possible to lift both copes and drags from the molding machines to the floor by hand. Lifting handles.

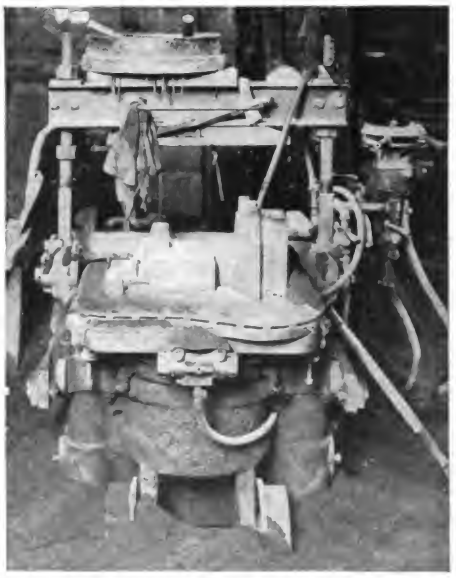

Fig. 9—Floor of transmission housing molds approaching completion, with the forward mold disassembled to show the details of construction. Fig. 10—Stripping-plate machine used for molding the copes for transmission housing

two at each end, are provided for this purpose. The flasks are machined on the parting edges and pin lugs at two opposite corners are drilled together to guarantee accuracy in centering the flasks on the molding machines and in closing the molds.

The transmission housing castings are shown in Fig. 1. The parting line is plainly visible as indicated by a thin fin. All the complicated inner structure with the inner hubs and box sections are carried in a single split core. The outer surface with the main connecting flange which is bolted to the crankcase in the finished motor, is made in green sand in the two halves of the mold.

Two jolt-ram stripping machines made by the Cleveland-Osborne Mfg. Co., Cleveland, are used, one to make the cope and the other the drag. Each of these machines is operated by two men. Two other workmen constitute a carry-away gang, placing the drags and closing the molds, while another man inserts the cores and yet another lutes the joints around and between the two half-cores. This gang of eight men makes and pours as many as 185 molds in nine hours. This speed again is attained through perfect co-ordination and foresight in planning.

The two molding machines are placed upon opposite sides of a sand heap, and the molds are removed and placed in double rows starting at a line about 40 ft. from the machines and working back toward them. Facing sand is delivered in a box which has one side open and is fitted with supports which bring the bottom of the box to the height of the table on the molding machine. The flasks are piled in order only a short distance from each of the machines and the bottom boards are directly back of the drag machine. Two hand rammers are set ready at hand beside each machine and both operators peen the facing sand before the backing sand is placed and the table with the pattern and flask is jolted. All hand tools used are kept in designated places on the machine. As soon as a row of drags is set, two clamps and wedges are placed beside each, and the cores are delivered at the end of the aisle along which the molds are to be assembled. The bottom half core is set in place in each of the drags in succession, the top half core and small strainer core immediately following. The gang which is carrying the molds from the machine then brings a cope and drag alternately, placing the draw in a new row adjacent or setting a cope on the row of drags which is ready. Loose flask pins are used. These are removed and set ahead as each succeeding mold is closed. In Fig. 9 the last row of drags for the day has been completed and part of the coring is finished. The adjacent row is ready except for fixing and wedging the clamps which are leaned in position against the molds. When the molds are closed the end joints including the line between the two halves of the main core are daubed with a mixture of molding sand and water mixed to the consistency of mortar. This mixture has been found much more satisfactory for "mudding-up" than was a mixture of fire clay which formerly was employed.

An interesting detail is observed in pouring these thin-sectioned, intricate transmission housings. A rectangular gate is formed in the cope directly over the portion of the casting which in the finished motor surrounds the

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transmission gears. This rectangular gate or box, about 3 x 4 in., connects with a similar rectangular runner in the upper half of the core through a small circular tapered hole only about 1 in. in diameter at the top. A strainer core, shown at J, Fig. 9, is dropped into the rectangular gate in the upper portion of the core, before the cope is set in place. Thus the gate in the cope is in effect a pouring box in the green sand with a circular opening which leads to the strainer below. The circular opening is covered as soon as the mold is closed by a perfectly fitting disk of tin. When the metal is poured it rises in the gate, floating to the top any impurities which are present, until the tin disk burns through allowing the metal to pass down through the circular opening and past the strainer through the runner to the bottom.

The two halves of the main core are made on two machines. Three men operate these two machines during the day and one machine is operated by one man at night. The total production averages 200 whole cores or 400 half cores each day. The drag core box has four loose pieces, two of which remain within the box when core is drawn, and two are drawn away laterally after the core is on the plate. The cope half corebox has two loose pieces which are drawn back when the core is out of the box. Two L-shaped rod arbors are used in each core. The same sand mixture is used for the bell or main flange section of the transmission cores as is used for the cylinder cores, but the facing sand is dry sand mixed thick with the oil compound and the backing is mixed with the American Gum Products Co. binder previously mentioned.

Three Whiting cupolas, one lined to 54 in. and the other two to 60 in., provide the metal for the various castings. The average melt is about 50 tons per day and the capacity is 70 tons. Automobile cylinders are poured from a metal of the following analysis:

	Per cent
Total carbon	3.30 to 3.50
Combined carbon	0.40 to 0.45
Graphitic carbon	2.80 to 3.00
Manganese	0.65 to 0.80
Phosphorus	0.30 to 0.35
Sulphur	less than 0.10
Silicon	2.00 to 2.20

This mixture develops a tensile strength of from 28,000 to 32,000 lbs. per sq. in. The transverse strength is from 3.000 to 3,500 lbs. per sq. in., and the Brinell hardness is from 410 to 430.

Another gray iron mixture which is used extensively has the following average analysis:

	Per cent
Total carbon	3.30 to 3.60
Combined carbon	0.35 to 0.50
Graphitic carbon	2.95 to 3.10
Manganese	0.60 to 0.80
Phosphorus	0.35 to 0.40
Sulphur	less than 0.10
Silicon	2.25 to 2.40

The tensile strength of this metal is from 25,000 to 28,000 lbs. per sq. in., the transverse strength from 2,500 to 3,000 lbs. per sq. in. and the Brinell hardness is from 440 to 470.

About 300 lbs. of coke per ton of iron is used in the cupola, and in some classes of castings a metal containing from 15 to 18 per cent of steel is used. The metal is poured from the cupola into ladle cars which run upon a system of tracks along the outer aisles of the two side bays and along a double track in the central aisle. Self-skimming hand shakes are used to carry the metal from the ladle cars to the different molding floors.

All castings are cleaned by tumbling. The cylinder castings are welded to correct minor defects which develop in a few cases. The welding room is shown in Fig. 11. Before welding the castings are placed in the oil-fired annealing furnace shown and raised to a cherry-red heat.

Fig. 11—Annealing ovens used to preheat cylinder castings for welding

They are removed and oxy-acetylene welded while still hot. They then are returned to the furnace and annealed to remove any chance resulting stress.

An Opportunity for Auto Painters

Auto painting shops that haven't a top trimming department are neglecting a most profitable source of revenue. Only a small space is required and the equipment is inexpensive. The top trimming trade is not hard to learn and shops can usually secure workmen skilled in this work to handle the trimming jobs for them. As rubber top materials are usually uniform in texture and grain, a limited stock is sufficient to take care of all demands and consequently there is little outlay of money necessary.

If the auto refinishing shop has a reputation for good painting work its customers will be glad to give it their top trimming work. Autoists usually have a tendency to keep the old top on the car as long as possible and a little salesmanship on the part of the owner of the refinishing shop is sufficient to convince them of the desirability of having a new top put on.

Staybestos Secures Pioneer Brake Lining Man

E. B. Knowles, one of the pioneers in the brake lining business, is now secretary and general manager, Staybestos Mfg. Co., Philadelphia. For the past seven years he has been connected with the Thermoid Rubber Co., Trenton, N. J., resigning from that company to go with the makers of S-M-C asbestos brake lining.

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Piracy of Trade Marks Abroad

The Influence of This Upon American Manufacturers, and Especially Makers of Cars and Trucks—Recent Eventful Happenings

QUITE recently the whole country was startled by the attempt of a Portuguese or Spaniard, Manuel de Silva Carmo by name, to take out trade mark registration in a considerable number of European and South American countries of the trade names and marks of a large number of leading motor cars and trucks. If he had been successful in this attempt, and no one can say as yet what the precise outcome will be, it would have been necessary for the manufacturers of those cars and trucks to pay him for permission to bring their products, with the trade marked name on them, into those countries, or else to buy outright from him the right to use their own trade marks in those countries.

In this particular case, Carmo has already obtained possession in 13 countries of the trade marks of five American cars, and will, unless the opposition is successful, become the possessor of 37 additional trade marks of American cars. Among those effected are: Auburn, Grant, Hackett, Haynes, Jackson, Jordan, Kissel, Lexington, McFarland, Maxwell, Mercer, Mitchell, Moline, National, Oakland, Paige, Saxon, Stearns, Stutz, Velie, Westcott, White and Winton.

Carmo came to New York last summer and visited the offices of a number of automobile companies with proposals to become their agent in Portugal, and in particular sought to make terms with the makers of the Henderson. At that time an attempt had already been made to pirate the trade mark of the Henderson, and the case is still being fought in Portuguese courts.

Carmo studied the automobile industry and obtained the information needed in his effort to control the automobiles for which he saw a future in the export business.

The effort to combat Carmo's plan will be carried on in the courts and by diplomatic action. The American Manufacturers' Export Association, co-operating with the National Automobile Chamber of Commerce, asked the State Department to instruct our ambassador at Portugal to protect the interests of the manufacturers.

American manufacturers will be fully safeguarded against Carmo only if their applications for registry are made in the 13 Berne Convention countries before Carmo obtains registry at Berne or in the individual countries. Even if the protest is filed in Portugal before Carmo completes possession of the trade marks an individual suit in each case may be necessary, and under the trade mark law in Portugal and some of the other countries the American owners might be beaten in court despite the brazenness of the piracy. Such piracy was very common in Scandinavia and in all countries where the first to register a trade mark is protected, as against the first to use the trademark. These countries are Argentina, Austria, Bolivia, Chile, Costa Rica, Cuba, Germany, Guatemala, Hungary, Japan, Nicaragua, Norway, Paraguay, Portugal, Serbia, Sweden, Turkey, Uruguay, and Venezuela.

Under these circumstances, which have evoked action by our largest national bodies, and by the State Department, it is wise to look into the situation and see what is necessary. According to William E. Richards, a patent expert who has given much study to trade marks, American manufacturers and traders must, for safety's sake, carefully observe the following rules if they wish to succeed in their export business and avoid the serious difficulties which many have encountered.

First, they must register each and every trade mark used by them upon their goods, in their own name, and in every country in which the goods are sold.

Second, register the trade marks before the goods are shipped abroad and, if possible, before the trade marks are advertised in trade journals which will reach foreign countries.

Third, where the same mark is used or likely to be used upon different articles of the same general class, make certain that the registration covers all such articles.

Fourth, where the same mark is used upon articles which are found in different classes, effect a separate registration for each distinct class.

It must be remembered that the practice in foreign countries differs materially from that in the United States.

In the United States the right to a trade mark depends upon adoption and use, and belongs to that person who was the first to adopt and use the mark.

In foreign countries, almost without exception, prior use is not necessary, and the ownership of a mark depends upon its registration, the first who registers it being regarded as the owner either absolutely or until his right thereto is successfully contested.

In many such countries the prior use of a mark in the country itself has no effect upon the owner's right to that mark, and the one who first registers it is protected by the courts to the exclusion of the real owner who may have made the mark popular in his own and foreign countries.

Another point: In many foreign countries a trade mark must be registered before it is used, and it is an offense, punishable by severe penalties, to sell goods with a trade mark appearing thereon until that trade mark has been registered. This affects the local trader as well as the exporter in this country, and a failure to observe the law is liable to result in heavy damages and great prejudice to business interests.

Many foreign laws permit the registration of marks that would not be recognized as valid marks under the United States practice. For instance, labels intended to be applied to goods or their containers, which may not contain any registerable or valuable features as understood in this country, can and should be registered in the countries which permit this, and these are quite numerous, in order to secure the fullest protection. Geographical terms are also registerable under the laws of many foreign countries, as are also surnames when written or printed in a special or distinctive style.

The dangers of piracy may be said to be five-fold, and may be classified as follows:

1. Actual Piracy—The registration by a foreigner of an unprotected, well known, and valuable trade mark, to the

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prejudice of the real owner who has neglected to protect his property. There are a great number of instances of this nature, and in most cases the real owner has been obliged to cease using his own mark in such country, or to acquire the right to the use thereof from the registrant.

2. Imitation-Counterfeiting—A trade mark owner who neglects to register his marks abroad frequently finds his market flooded with inferior goods bearing imitations or counterfeits of his name or marks.

3. Registration in Name of Local Agents—This is a frequent cause of trouble and expense in cases where disagreements have arisen, or new agents have been selected, as the mark is the property of the agent in whose name it was registered.

4. Reregistration of Marks—Owners who allow the term for which a registration has been effected to expire without procuring a reregistration sometimes find that an unscrupulous trader has stepped in and secured the registration of the mark in his own name. This occasions serious loss in cases where marks have become well known and valuable through long use.

5. Foreign Made Goods Marked "American."—Frequent comments have been made by the Bureau of Foreign and Domestic Commerce regarding this class of piracy and wrongful marking, instances of which are very numerous.

As a recent example of the first class of piracy may be mentioned the case of the Roamer Motor Co. whose trade mark was registered by a Spanish-American. Typical of the second class of piracy is the instance which follows relative to Japan and China, involving some 40 cases of counterfeiting of a single brand of milk.

The case of Simmonds, Slocum and Sands is illustrative of the third class. In this class the mark of the firm was registered by a local agent whose name was placed on the enemy trading list, causing great inconvenience.

The Qui Vive Tabulating Co. had registered their trade mark in a southern republic for a ten-year term and had an established business in that country; unfortunately they neglected to renew their registration at the end of the term, and their mark was appropriated and registered by another.

As an example of the fifth class may be mentioned the case reported in commerce reports where, in Java, imported Dutch corsets and brassieres were remarked as American goods and sold as importations from the United States.

Several of the examples above referred to have been taken from the publications of the Chamber of Commerce of the U. S. A. These are not exceptional cases but are merely typical of numerous instances of piracy which are constantly occurring. Hardly a month passes but that the official trade mark journals of Cuba and the South American countries contain flagrant cases of the piracy of some of the best known and most widely advertised American marks which were unregistered in those countries by their real owners.

The comparatively trifling cost of registration in foreign countries makes this expense stem trifling when the value of the protection it affords is taken into consideration.

When compared with other forms of insurance which are regularly secured by business men at the cost of substantial premiums, it would seem that the protection afforded by such registrations is well worth the modest sum needed for obtaining it, whether the manufacturer is now exporting his goods or not, for in the latter case the demand for the goods or the desirability of an export trade may arise at any time, and if his marks have been registered they are protected for such use as he may wish to make of them, and are safe from the depredations of the trade mark pirate.

It seems certain that there is no other form of commercial insurance that is so valuable to manufacturers as trade mark protection, especially in countries where the first applicant for registration is regarded as the owner of the mark, whether he has made the mark valuable by use or not.

The trade mark pirate, by risking a small outlay can, in the event of delay or neglect on the part of the rightful owner, secure registration in his own name, which will enable him either to kill his victim's trade or to demand a price which he himself fixes, for permission to continue trading under the mark.

Unprotected trade marks are frequently imitated or counterfeited in these countries, and there have been 40 distinct instances of the counterfeiting of the mark of a single well known brand of condensed milk.

A statement of the method whereby protection of trade marks may be obtained and enforced will be of interest, as the export trade to the far east is constantly becoming of greater and greater importance.

Japan—Trade marks may be registered under the provisions of the existing laws, and the counterfeiting, imitation or misuse of registered marks will be punished by the courts.

A treaty exists between the United States and Japan for the reciprocal protection of trade marks, and citizens of the United States are entitled to the protection afforded by the laws of that country.

Japan is also a member of the International Convention for the Protection of Industrial Property, and under the provisions of this convention any citizen who has filed an application for the registration of his trade mark in the United States, has four months' time from the date of such filing for filing his application for registration in Japan, enjoying an absolute right of priority during this time. A mark so registered in Japan is not liable to cancellation on the ground of non-use.

A further treaty, proclaimed August 11, 1908 between the United States and Japan, provides that trade marks duly registered by the citizens or subjects of one country in the appropriate office of the other country, shall have the same protection against infringement in all parts of China as in the territory and possessions of such other country.

This treaty also provides for the extension of the reciprocal protection of trade names, as provided under the International convention, between citizens or subjects of the two countries, within Chinese territory.

China—While there is no local law in this country providing for the registration of trade marks, the courts will punish the counterfeiting or imitation of the trade marks of citizens or subjects of countries having treaty relations with China which cover the subjects, the United States being one of such countries. Many instances have occurred where counterfeiters or imitators have been severely punished by the courts.

In order to establish evidence of ownership and, as far as possible, to warn against any infringement of rights, it is usual to register copies of trade marks and claims of

(Concluded on page 30)

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Vol. LXI MARCH, 1920 No. 12

Developments of the Export Financing

AUTOMOTIVE men in general, and executives in particular, are greatly interested in the development of export financing. With the huge production plans for 1920 this is a vital matter to many firms accustomed to receiving part of their money in advance and all of it immediately upon delivery. The output must be disposed of; to do so abroad necessitates some method of financing; the Edge bill was supposed to provide the machinery to do this financing work. Unfortunately, now that the measure has become a law, only one company has been formed under it, and even that in a half-hearted way which does not augur well for its success. It would be interesting to know just why this measure has not produced the desired, in fact the expected, results. It is a wonder, too, that the automotive manufacturers have not gotten together to form an export financing company of their own, under the Edge provisions, which permits the sale of debentures based on credit to the extent of ten times the capital stock, which must exceed two millions. Twenty manufacturers each putting in $100,000, could finance in this manner the sale of approximately 10,000 cars at one time, and on the basis of 90 days actual payment could turn over four times a year, or could handle the financing of 40,000 cars.

Efficiency of Car Lengths

THE point has been made by someone that the present vogue of a long bonnet having straight horizontal lines may enchance the appearance of the cars, but in the case of the smaller machines of relatively short wheelbase, it cuts into the length for the passengers to a considerable extent. And this reduction in leg room for passenger's comfort, gained for the sake of appearance and appearance only, does not constitute an efficient arrangement of the available length.

If two, three or four inches, as the case may be, were taken off the body space and added to the length of the bonnet, solely to make that part appear longer, and thus the whole car longer and lower, and if this made the passengers less comfortable, and thus less satisfied with the car, obviously this change was not good business.

The subtraction of a few inches from the bonnet length so as to provide the passengers with more leg room, need not necessarily make the bonnet look short and dumpy. In fact, if it is done with care, and the long horizontal lines retained, it should not affect the appearance of the car at all, for what is taken from the bonnet is added farther back, and thus the length is the same and the appearance should be also.

In redesigning, too, this thought can be and should be kept well to the front, that the shorter the bonnet length in proportion to the total length the greater will be the chassis' length efficiency. Short bonnets mean long and comfortable passenger compartments, and this comfort is in the last analysis what people buy the car for. By subtracting as little as ¼ in. from the bore of a six-cylinder motor, and economizing in the placing of fan and other units, it ought to be possible to add 3 in. to the passenger's length. And this, divided into 1 in. for the driver's part and 2 in. for the tonneau, represents just the difference between a roomy, comfortable, pleasant space in which to ride and a cramped, uncomfortable, undesirable one. One will sell more cars, the other will not.

The Era of Motor Truck Transportation

ONE of the ways in which the present distressing freight congestion is going to be relieved is by the wide use of motor trucks, not alone for haulage within city limits, but for actual long distance highway transportation of goods. One of the ways in which the country at large has adopted the motor truck may be seen in the good roads situation.

The funds available for the construction of hard surfaced roads in the United States in 1920 are more than three and almost four times as much as in any previous year. The various amounts appropriated by the government, the state legislatures and the various counties and smaller local bodies is estimated by the U. S. Dept. of Agriculture at $633,000,000, while leading road authorities believe the appropriations will reach a final total of $1,000,000,000. The previous maximum yearly expenditure was less than $200,000,000.

By an odd twist of circumstances it may easily work out that the motor trucks of the country for whom the roads will be built in large part will be compelled to transport the material from which the roads will be made. In fact, if they do not, it is a question whether the road will be built as scheduled, for the amount of material needed is far in excess of the ability of the railroads to transport. If it be considered that only 400 tons of material are needed per mile of finished road, this means not less than 120,000,000 tons of materials. On the basis of using the largest sized freight cars generally applied to this class of materials, it would mean the use of 1,500,000 freight cars, and using the smaller sizes 2,000,000 cars or more. With a large present shortage of cars, where would any such number as this come from? It means that the long and short hauls will have to be watched with extreme care, trucks used on all short hauls and as many of the long hauls as is possible.

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Unusually Wide Side-Opening Heat-Treatment Furnace

A New Unit of Evident Utility Has the Additional Meritorious Feature of Division Into Compartments, Making It Capable of Small as Well as Large Work

The long piece of steel requiring heat treatment, such as the Diesel engine crankshaft, the large motor truck driving shaft, or similar work of unusual length, has been a difficult proposition for the heat treating room. This has been true for two reasons, its great length has made the piece a mean thing to handle, and of the greater moment perhaps, no ordinary heat-treating furnace was large enough to handle it. At times this has necessitated the conversion of other types of large or rather, long furnaces for the time being. At other times the work has been attempted in two parts, with little success.

A new furnace has been developed by the W. S. Rockwell Co., and illustrated in Figs. 1 and 2 herewith, which obviates all these troubles. This it should be explained is of the side opening type which does not have the disadvantages of the car type, or of the sectional roof or bung type, which are commonly used for the general range of heat treating work, considering its wide range of sizes and shapes of material to be handled. This furnace was originally built with the chamber 5 ft. 9 in. long from front to rear and 36 ft. wide. Due to the advantages demonstrated by its operation, and in order to anneal and heat treat the largest shafts and similar pieces handled in the forge shop, the furnace has now been widened to provide a working chamber 105 ft. in the clear, the length remaining the same. The widened furnace is shown in Fig. 1, while the original which has a width of but 36 ft., may be seen in Fig. 2, the latter indicating as well the cellular or unit construction of the furnace and its doors, which permits of using each 5 ft. length as a separate chamber when desired. This construction, too, it not limited to the present size of 105 ft., but can be extended almost indefinitely, in multiples of 5 ft.

As now built, the furnace is provided with movable partition walls and can be divided into seven separate chambers, each approximately 5 ft. wide. The doors covering the working openings can be raised or lowered independently of one another. Doors are dovetailed and form guides within themselves that prevent the escape of hot gases, the only gases which escape being the exhaust gases that leave through the regular vents.

The doors are raised and lowered by compressed air and counterweights. The counterweights weigh almost as much as the doors, so that very little compressed air is required. The individual valves for operating the air hoists are located at the side of the furnace, from which point the operator can see the doors.

The roof of this furnace is constructed of flat tiles, avoiding the thrust caused by the ordinary arch construction. The roof and the door lift rigs are suspended from the overhead truss as shown in the illustrations.

Oil or gas may be used as fuel. Combustion takes place in a series of combustion chambers located under the hearth, the hot gases from which pass into the heating

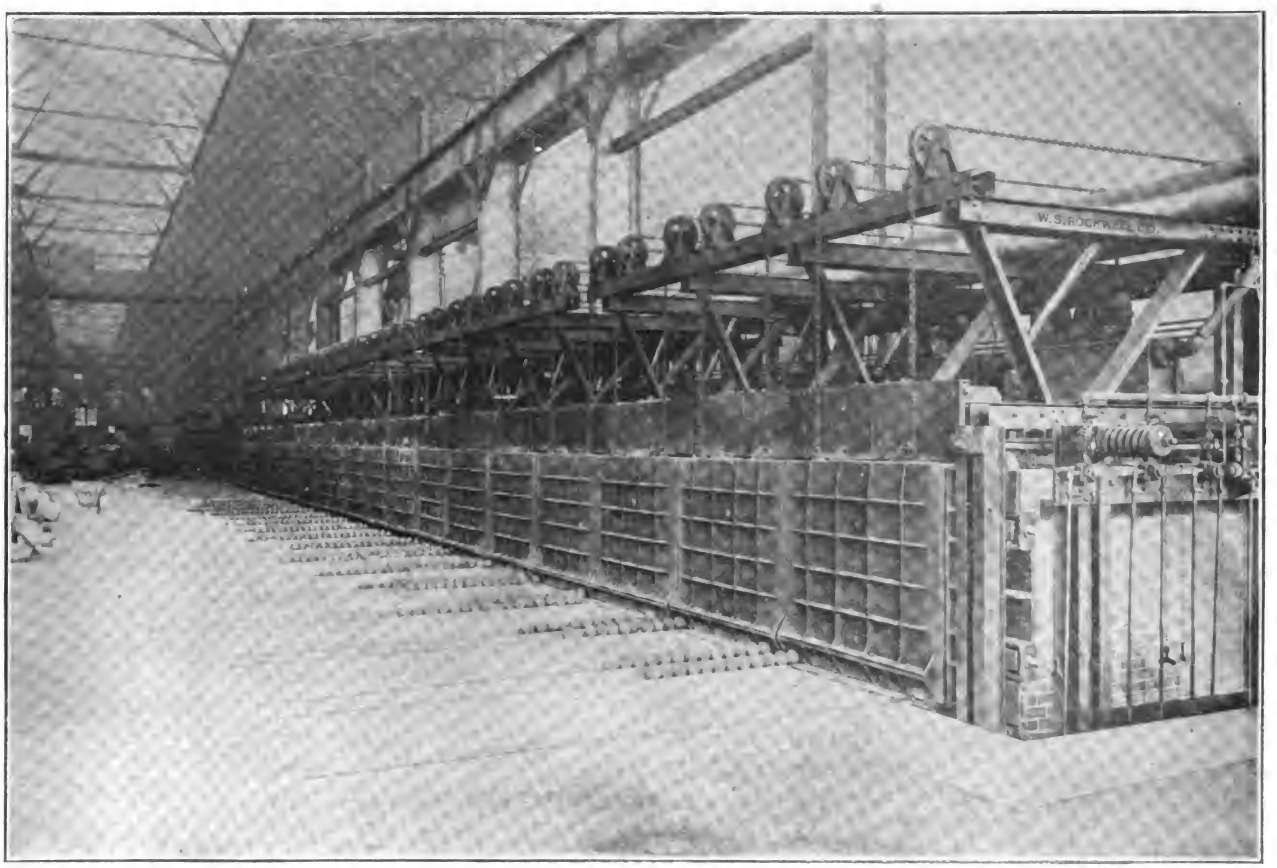

Fig. 1—Front view of the underfired side-opening heat-treatment furnace, in the 105 ft. width, this view giving a good idea of its size

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chamber in such manner as to insure a uniform application of heat to the material in the heating chamber. The location of the combustion chambers under the hearth insures a hot bottom and the best of heating conditions. Somes of the gases in the heating chamber are siphoned back into the combustion chambers, insuring a complete circulation and uniformity of temperature throughout the heating chamber.

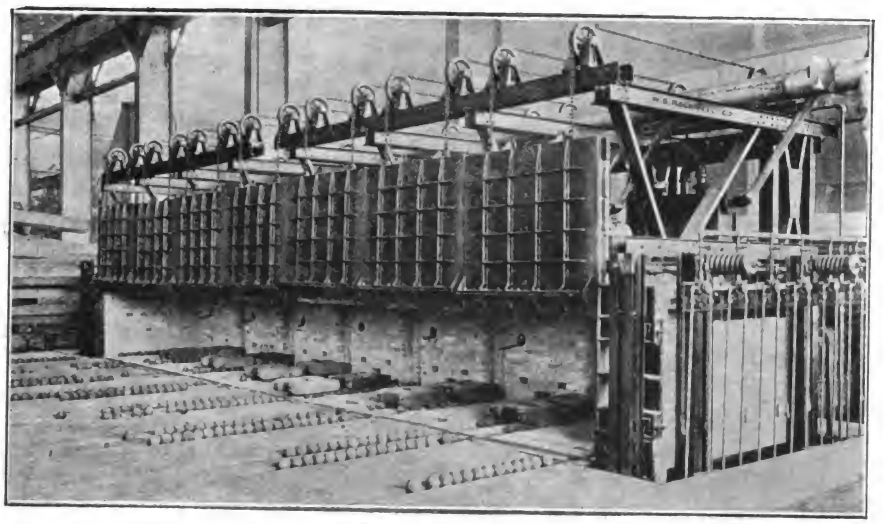

Fig. 2—Front view of underfired side-opening heat-treatment furnace with all doors open, chamber at full annealing heat. The 36 ft. width

Also the heat in the spent gases is utilized. The spent gases as they leave the vents circulate through the preheaters shown at the rear of the furnace and arranged above the vents. The air in these preheaters thus returns through the burners the greater part of the heat in the spent gases that would otherwise be lost. The fuel consumption in this furnace is extremely low due to the efficient application of the heat and the utilization of the waste heat ordinarily lost.

Provision is made for the convenient control of the burners from above the floor level at the rear of the furnace.

Expansion of the brickwork, or of the furnace as a whole, is taken up by heavy springs shown at the side of the furnace. The overhead trusswork has been so divided as to prevent any distortion due to the heat in the furnace. If the pieces to be heated are small they may be placed on the floor of the furnace; or if they are long and rather unwieldy heavy cast steel trucks may be used, upon which the pieces are supported above the floor level, special provision also being made to take care of the expansion of the pieces within the furnace.

This side-opening furnace is equally good for heating long, fairly light rods. These may be laid directly on the furnace hearth and pulled out one at a time for quenching or other treatment. The doors may be opened only enough to permit of a piece being withdrawn, thus conserving the heat in the furnace. Doors are easily controlled by the air hoist door-lifting mechanism.

The flexibility of the furnace, and the fact that it insures good heating and handling conditions, make it a most desirable and efficient heat-treatment furnace in a forge shop, especially for long and heavy work. Microscopic examinations of pieces heated in this side-opening furnace prove that the heating conditions are ideal.

Neither the sectional roof nor the car type furnace, both of which are built to meet certain conditions, offers the many advantages of this underfired side-opening furnace. Both the sectional roof and car type furnaces lose a very large amount of heat when material is discharged; and while it is possible to build the sectional roof type of furnace in such a manner as to get a hot floor and good heating conditions, such a construction is not so advantageous as this side-opening furnace. In the car type furnace the difficulty has always been to obtain equally high temperature at the bottom of the chamber (top of car) as in the upper portions of the chamber, so that material is apt to be overheated on top and underheated on the bottom. Neither of these types of furnace lends itself readily to division into various sized chambers, and therefore lacks the flexibility of this open-side furnace with its large side opening. Nor do the sectional roof and car furnaces afford convenient removal of a portion of the charge—for instance, a short section of shaft.

Taken all in all, this new type of furnace has so many advantages it will not be strange if it finds wide adoption, both in the two present sizes, the 30 ft. and 105 ft. widths, but also in a number of other width, some of them much greater.

New Type of British Airplane Engine

Now that the airplane engine has been refined in so many other mechanical ways, and the power output per unit of weight reduced to so low and so satisfactory a figure, inventors and practical engineers are beginning to work on the problem of quieting the airplane engine. The report comes from Manchester, England, through Henry F. Grady, active commercial attache, that tests have been completed there by Capt. William P. Durtnall of a new type of airplane engine which will be silent, and from which the danger of fire in the air has been removed. The tests were made on a converted engine that had been previously operated on the Otto cycle system.

At present the exhaust pressure of the gases is very high in ordinary airplane engines, producing considerable noise. Under the system used on the Bowles and Durtnall engine, the exhaust gases leave the engine at ¼-pound pressure per square inch, which results in "silent" operation. With so great a reduction of the temperature it is claimed to be impossible to get a flame from the exhaust in any circumstances. The further claim is made that cheap heavy crude oil can be used in these engine, and that full power can be produced at altitudes up to 20,000 feet.

Hawthorne, Leslie & Co., of Newcastle, are reported to have secured the rights of these engine improvements for use on the large power internal combustion railway locomotives which they are now building.

American automobile manufacturers have asked Congress to cut down the import duty from 45 to 30 per cent, so as to stimulate car imports, and incidentally to bring down import duties in other countries which work on a reciprocal basis.

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Reserve Power and Fuel Economy of New Tractor Engine

Details of the Design and Construction of Stearns Motor Show Excess of Power and Torque Capacity Beyond Three to Four Plow Rating Needs

AN excess of the power developed over that needed to pull three or in some circumstances, four large plows marks the new motor which has just been placed on the market by the Stearns Motor Mfg. Co., Ludington, Mich. This is of simple but pleasing lines, with four water-cooled cylinders, cast in a block and with detachable head. The overhead valves are enclosed in a light metal housing which can be removed by taking off a few nuts. On the valve rod side of the engine large removable plates give access of the adjustable end of the tappet rods. In general arrangement the right side carrying the pump shaft, from the forward end of which the cooling fan is driven by means of an unusually wide leather belt. On the left side, except the ribbed exhaust manifold and the carbureter which has a very short attachment to the cylinder block, the motor is entirely free. It is this simplicity and cleanliness of arrangement that gives the motor its businesslike appearance.

In the way of power, on gasoline it develops on the block 41 at 800 r.p.m., 45 at 900, and 47 at 950. This is the speed range within which the motor is designed to operate, but it can be speeded up, and when this is done an output of 56½ h.p. at 1,350 r.p.m. was reached. On kerosene it operates almost as well, developing 38 h.p. at 800, which is but 7 per cent less than on gasoline which costs almost twice as much (26 against 16 cents).

In this same range the torque curve is remarkably flat, as the curve which is reproduced elsewhere shows. This averages about 202 lbs. at 15.75 in. radius, varying from 195 at 200 r.p.m. up to 209 at 800, and reaching 195 again at 1,050. In addition to these exceptional outputs it is economical, showing a fuel consumption at all practically running speed of less than 0.6 lb. or 0.8 pint per h.p.-hour.

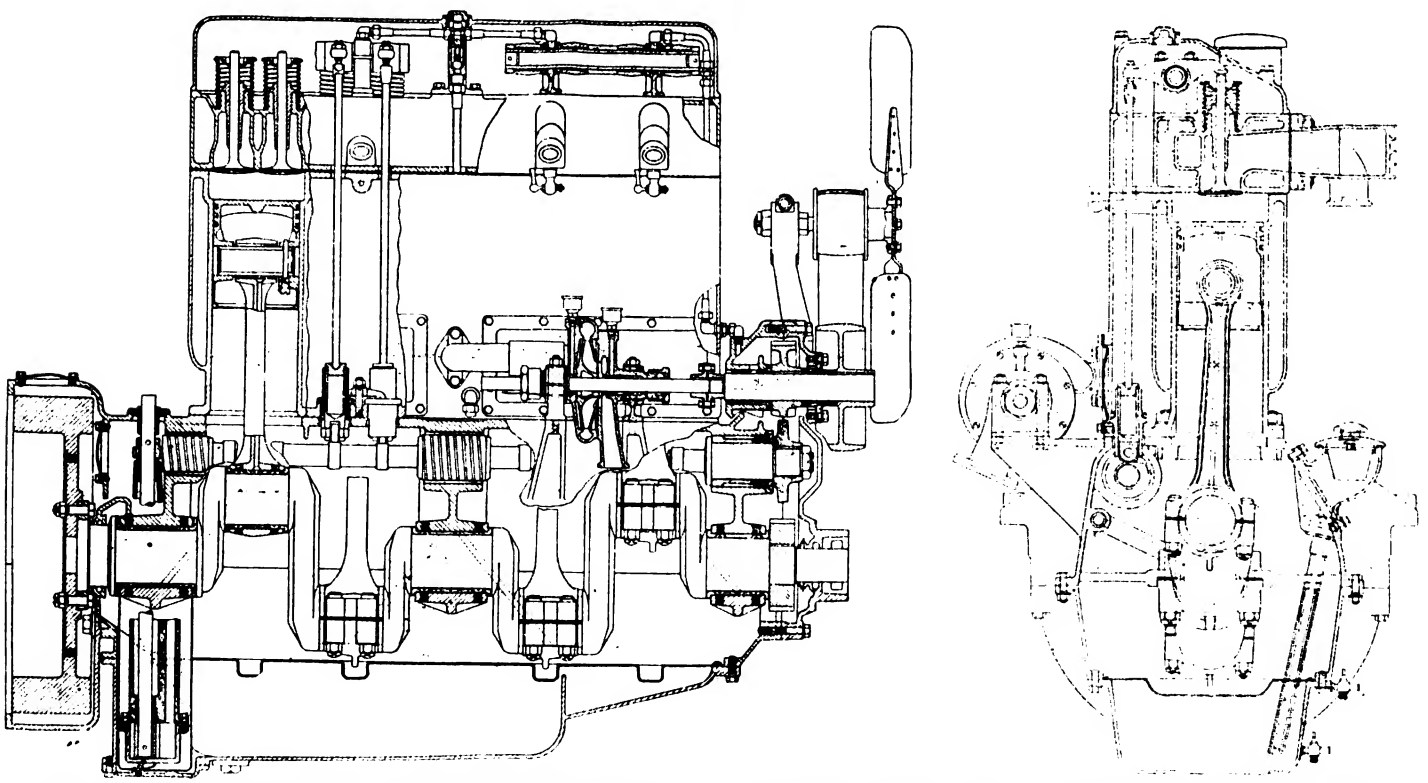
The design, for which Herbert P. Wollensak, general manager and chief engineer, is responsible, provides accuracy of production, which is very valuable to the user, as, for instance, the combustion chambers are machined all over and reamed with possible variation of less than 1/1000 in. This means that the compression is exactly the same in all cylinders, so the resulting explosions will also be. The net result is an absolutely equal output of power for each of the four cylinders, so that the motor has a smoothness of action which is comparable with that of a six-cylinder motor.

Other outstanding features are the large sizes of bearing and journal pins all over, the length of the journals, the accessibility of all the working parts, and the size and special materials used throughout the motor.

Cylinders

The cylinder is made of a high grade close-grained gray iron cast four enbloc, barrels reamed and accurately ground to size. The combustion chamber is reamed to within .002 in. in diameter, which insures uniform combustion in each cylinder.

The cylinder head is made of the same quality of gray iron as the cylinder and bolted to the cylinder with 15 9/16 in. studs. Exceptionally large water space is provided for, and the gas inlet passage is of absolutely uniform shape and size throughout its entire length, thereby insuring correct corburetion with a minimum amount of



Figs. 1 and 2—Drawings showing construction of Stearns motor. In longitudinal section (Fig. 1 at left) note the extra large crankshaft bearings. Fig. 2 at right shows cross section

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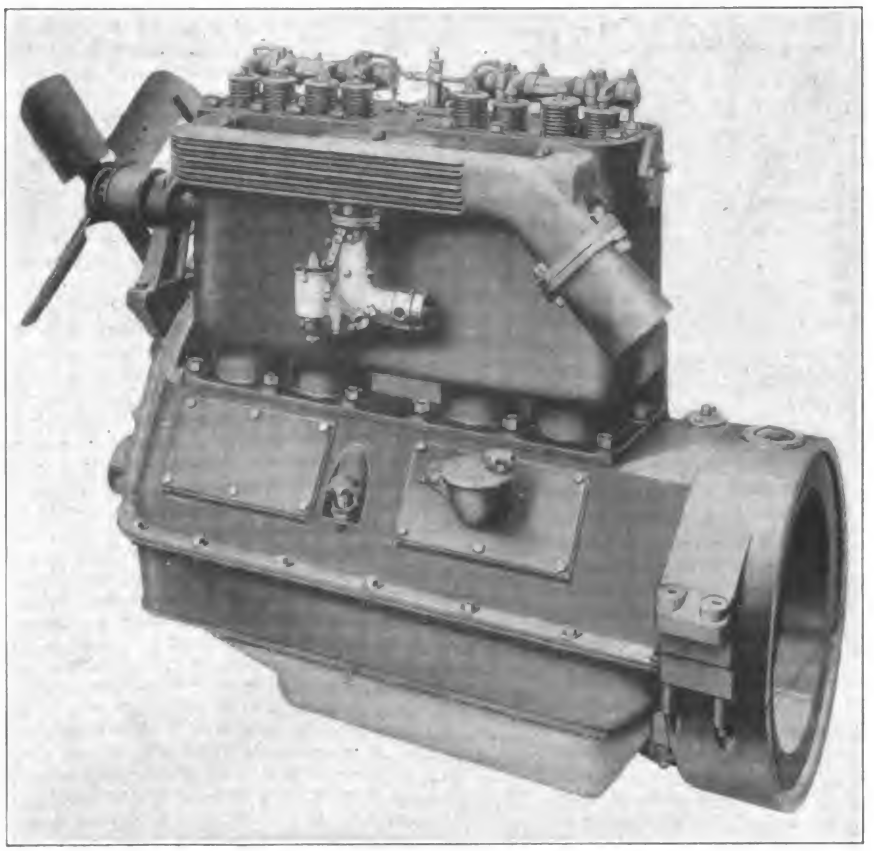

Fig. 3—Exhaust side of the motor showing remarkable simplicity

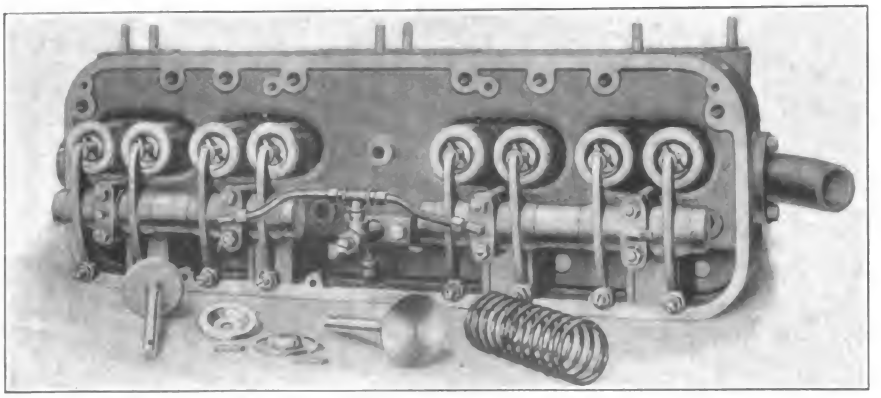

Fig. 4—Separate view of assembled cylinder head showing valves in place

fuel. It is also so designed that it follows the heated exhaust passage, which assists this carburetion. The valve stem guide bushings are pressed into the cylinder head and can easily be replaced when worn.

Rocker shaft mechanism rigidly supported by two brackets. Rocker levers are made of .25 carbon steel—case hardened on valve end—threaded on other end for valve clearance adjusting screw. This screw is case hardened with an extremely large ball end, fitting in a cup so arranged that the lubricating oil will settle in it and assure absolute lubrication. The rocker shaft is seamless steel tubing heat treated to the sclerescope hardness of 45 which insures good wearing qualities. Oil is forced through this tube under pressure to all rocker bearings, all grease cups being eliminated.

Crankcase

The crankcase is made of high grade close-grained gray iron and is designed to give maximum rigidity with minimum weight. The main bearings are tied to the side walls with exceptionally wide flanges, and are supported with two heavy ribs. The bearing caps are set in a recess ½ in. deep and held in place by four ⅝ in. studs. Two large inspection holes are provided on one side of the crankcase, covers of which can be easily removed and through which all bearings can be inspected.

The lower cover is made in two pieces, the lower half of which acts as an oil reservoir and also contains troughs for connecting rod tips. These covers are so designed that all bearings adjustments can be made by removing simply the lower half. This can be removed without interfering in any way with any bearings or oil piping.

The crankshaft is made of .40 carbon

Fig. 5—Detail of piston, connecting rod and parts. Note husky sizes throughout

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steel heat treated and bearings accurately ground and lapped to size. The shaft is also accurately balanced on a Norton crankshaft balancing machine. Large oil holes are drilled through one shaft for lubricating the connecting rod bearings. An oil throw is provided on the front and rear end, eliminating the possibility of oil leaks to a minimum.

Crankshaft Bearings

All bearings throughout are of the highest grade bronze and of ample size. The main and connecting rod bearings are bronze backed with a high grade babbitt lining. The center main bearing is 2⅞ x 4½. Other bearings are proportionately large (refer to specifications on page 28).

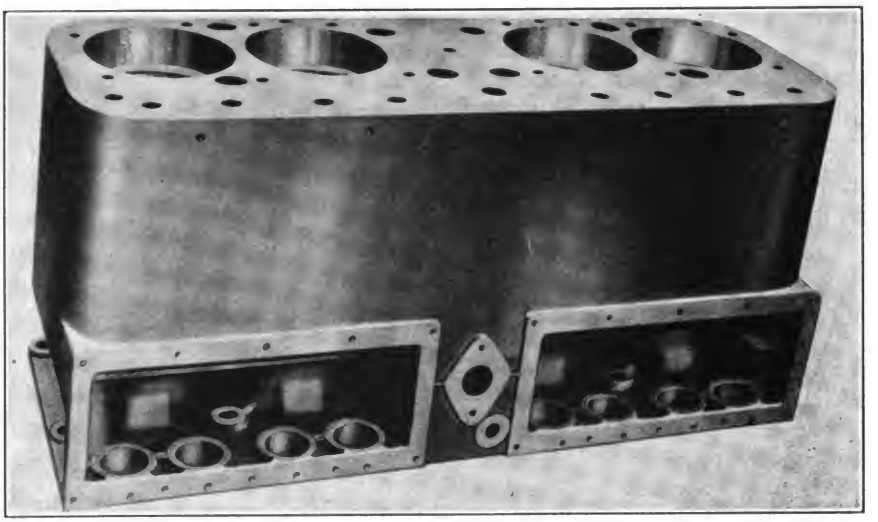

Fig. 6—Detail of cylinder block—openings near bottom are for valve plates

The connecting rod is made of .40 carbon steel heat treated to give maximum strength. The conecting rod cap is held in place with four ½ in. chrome vanadium steel heat treated bolts and special extra long nuts. The wrist pin end of this rod is arranged to hold a bronze wrist pin bushing.

The piston is made of the same grade of gray iron as the cylinder. The top of the piston is well ribbed and the wrist pin bosses are well supported. Grooves are provided for three piston rings, and the lower one acting as an oil ring. The skirt of the piston is provided with a liberal sized pin protruding entirely through both sides of the piston pin. This pin is securely licked in place by an ingeniously constructed lick washer.

Piston and Wrist Pin

The wrist pin is made of .20 carbon steel, case hardened and ground accurately to size. The size of this wrist pin is such as to insure long life with a minimum amount of wear.

The camshaft is made of 30 per cent carbon steel; cams and bearings are all case hardened and accurately ground to size. The camshaft runs in three large high grade bronze bushings. The end thrust is taken up through a large flange on the camshaft and through the front camshaft bearing, which is held in place by four large machine screws. The camshaft gear is held in place by a large hexagon nut.

Valve Tappets

The valve tappet is of the well known roller type of an extremely sturdy and light design. The roller is made of 3½ per cent nickel steel hardened and accurately ground to size. The roller pin is made of the same material, flats being milled on the end to insure this roller remaining in the correct relation to the cam. With this design the extreme thrust on the roller is eliminated with a corresponding decrease in wear. Valve tappet bushings are made of high grade case iron and held in place with a drop forged crab. The push rod is a hardened piece pressed into the valve tappet, which is also case hardened and accurately ground to size.

Valve tappet bushings are hardened steel and pressed into the valve tappet.

Oiling System

The oiling system is of the force feed and splash type,

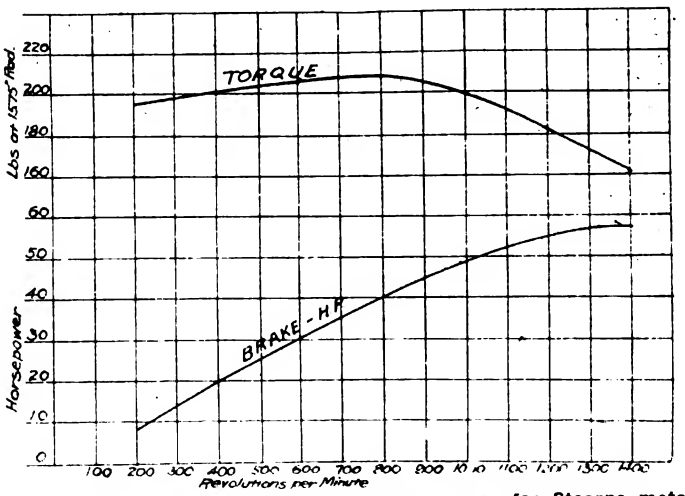

Fig. 7—Horsepower and torque output curves for Stearns motor

pressure being maintained when the motor is warm at 25 lbs. by a large gear pump entirely submerged in oil. This oil pump and drive are one unit and can be removed by simply taking out four cap screws bolted direct to the

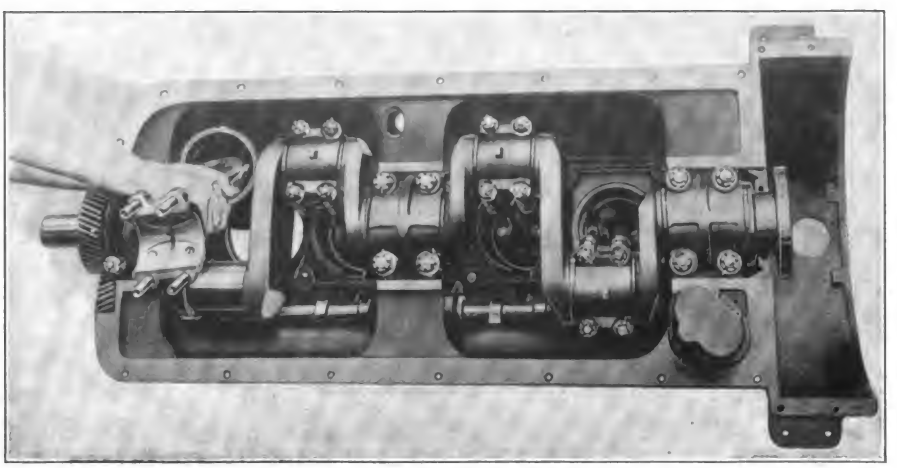

Fig. 8—Crankcase from below emphasizing accessibility of connecting rods

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crankcase and to the main oil header, which consists of a steel tube cast integral with the crankcase and eliminates all chance of leakage by doing away with all oil tubing. After the oil is forced through this lateral oil passage it is forced through a hollow crankshaft to each connecting rod and through a steel tube to the wrist pin, which insures force feed lubrication under pressure at each and every bearing. The oil is also forced from this laterial passage through a capper pipe to a pressure relief located on the top of the cylinder head and which can be adjusted to any required pressure by simply removing one plug on the cylinder head cover. The overflow of oil through this pressure relief lubricates the timing gears. The camshaft is lubricated by large spiral oil grooves which take their oil from the splash and spray in the crankcase. This engine is also provided with the bayonet type oil gauge and also with high and low level petcocks. In this way the operator can always check the quantity of oil he has in his base. There is a large oil filler located on the side of the crankcase which will permit the operator to pour his oil in this motor without the use of a funnel. A strainer of ample size is located in this filler so that all oil is strained before it goes into the motor. This filler does not act as a breather and is airtight when closed, to eliminate the possibility of dust being drawn into the motor, causing extreme wear.

The breather is located at the very top of the engine. The breathing action is taken up through the push rod chamber through the cylinder head cover and therefore by the time it reaches the breather the action is practically nil, but in addition to this fact the breather is provided with a diaphragm which will not allow any inward action, but which will allow all pressure into the crankcase to be released. The entire motor is enclosed and with this ingenious breather arrangement it is practically impossible for dust to get into the motor, which will insure long life. This breathing action also has another advantage as there will be a continual oil vapor through the push rod chamber and cylinder head, which in turn will lubricate the valve, the valve spring and the valve adjusting screw end.

Water Pump

The water pump is of the centrifugal type and of ample size to insure perfect cooling. It is rigidly supported by two brackets bolted to the crankcase and can be removed at any time by removing four hexagon nuts. The pump and the fan are driven by a large shaft of 1 to 1½ in. dia. with a bearing surface of 4½ in. On the outer end of this shaft is located the fan driving pulley.

The fan is a 22 in. steel stamping of the hub driven type running on a large Hyatt roller bearing and driven by a belt 2½ in. in width. Adjustment of this belt can be taken up by simply releasing one cap screw and turning an eccentric located in the fan bracket, which has sufficient eccentricity to allow for 1 in. fan belt adjustment.

The exhaust and inlet manifolds are cast integral and are of the hot spot type and of such a design as to insure the best results and economy when burning low grade fuels.

Timing Gears

The timing gears are 1⅜ in. face and are of the spiral type. The crankshaft and the magneto drive gears are drop forged steel. The camshaft gear is of high grade semi-steel. This gear drive has been designed in such a way as to eliminate all idler gears, thereby eliminating the greatest source of gear trouble.

The motor is also designed so that it can be equipped with any standard governor and so arranged that there are no flexible shafts.

Specifications of the Stearns Tractor Motor

General type	four cylinders vertical
Valve type	valves-in-head
Cylinder bore	4¾ in.
Stroke	6½ in.
Cylinders cast	en bloc
Cylinder material	cast iron..
Cylinder head	detachable
Cylinder head material	cast iron
Power output, gasoline	41 at 800 r.p.m.
	45 at 900 r.p.m.
	47 at 950 r.p.m.
Power output, kerosene	38 at 800 r.p.m.
Front main bearing	2⅞ in. dia. x 3½ in. long
Center main bearing	2⅞ in. dia. x 4½ in. long
Rear main bearing	2⅞ in. dia. x 4½ in. long
Connecting main bearing	2¾ in. dia. x 3½ in. long
Front camshaft bearing	2 in. dia. x 3⅜ in. long
Center camshaft bearing	2½ in. dia. x 3¾ in. long
Rear camshaft bearing	2 in. dia. x 2¼ in.long
Water pump and magneto drive bearings,	1½ in. dia. x 4½ in. long
Wrist pin bearing	1⅝ in. dia. x 2¼ in. long
Rocker shaft bearings	1 3/32 in. dia. x 1½ in. long
Valve diameter	2¼ in. clear opening
Carbureter size	1½ in. S. A. E.
Type AU—	With bell housing for tractors of unit construction
Type A	Open fly wheel type, without bell housing
Fuel consumption	0.6 lb. per b.h.p.hour
	0.8 pint per b.h.p.hour
Torque, maximum	209 lbs. at 15.75 in. rad.
Average	202 lbs. within speed range
Rating in plowing capacity	2 to 3 and 3 to 4 plows

German Automobile Manufacturers Form Syndicate

Those who remember how the German manufacturers in various industries have in recent years combined for mutual protection and increased power both at home and abroad will not be greatly surprised to know that the German press reports the formation of an automobile cartel or syndicate under the style Deutscher Automobil-Konzern G. m. b. H. for the purpose of conducting the sales of its member according to a joint program. The constituent concerns are the Dux-Automobil-Werke Aktiengesellschaft, in Wahren, near Leipzig; the C. D. Magirus Aktien-Gesellschaft, in Ulm; the Voglaendische Maschinenfabriek, formerly Dietrich Aktien-Gesellschaft, and the Presto-Werke Aktien-Gesellschaft, in Chemnitz. It is expected other concerns will be admitted to the cartel from time to time. No public announcements have yet been made concerning the method of organization of this new cartel, but it is understood that they will maintain joint sales agencies abroad and will probably limit each one of the constituent bodies to a building program which will serve the double purpose of reducing the cost of production and preventing overproduction.

January imports increased $100,000,000 over December, and exports but $49,000,000, showing a remarkable decrease in the unfavorable balance of trade.

San Francisco will hold the first national aeronautical exposition on the Pacific coast, April 21 to 28.

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Deep Drawn Chrome-Vanadium Stampings Now Available

A notable recent achievement in the working of alloy steels of unusual hardness is the stamping of a chrome-vanadium alloy material running 0.60 in carbon, which has been accomplished on a commercial basis by the Alloy Parts Mfg. Co., Canton, O., through the use of a process evolved by the National Pressed Steel Co., Massillon, O., during the war. Cup races and cones for standard ball bearings, spring shackle bolts, piston pins and other products are being manufactured from this material.

This alloy steel was first rolled by the National Pressed Steel Co. for use as light armor plate during the war. The appearance of German soldiers on the western front wearing body shields three years ago brought out the first demand for a plate remarkably strong and yet light, and it was with a view to equipping allied soldiers with similar shields that alloy steel manufacturers were called upon by the War Department to produce something at least the equal of the German product.

Many samples of plates were submitted and from among these the plates of the National Pressed Steel Co. were adopted. In ballistic tests conducted by the War Department five shots of copper-jacketed bullets were driven into a 5 in. circle of a 0.109375 in. plate from a Springfield rifle at 50 yards. Under the rules of the tests the shots could crack the plate but must not crack it sufficiently to pass water. This special alloy, it is stated, withstood six shots in a 2½ in. circle without cracking. It was later found that American soldiers would not wear body shields and the alloy plate was ordered by the War Department for use as armor for tanks.

The manufacturer states that drawn shackle bolt tubes with a thickness of 0.140625 in. have given a factor of safety of 15 to 1 in use on five-ton trucks displacing a solid low carbon bolt 1 in. in thickness; also that the steel, heat treated, registers a mark of 700 Brinell with the extra advantage over case hardened material of being of the same texture all the way through. Bearing cups and cones manufactured out of this steel have undergone laboratory tests said to be equivalent to 300,000 road miles without showing wear.

Since the signing of the armistice the National Pressed Steel Co. has been furnishing this alloy steel exclusively to the Alloy Parts Mfg. Co. for automotive parts.

Big English Fish Distribution Combination Uses Motorboats

A big combination of fishing interests on the east coast of Britain is based upon the use of motorboats for the quick delivery of the fish to the markets. According to Consul Byington, Hull, England, trawler owners at Hull Fleetwood, North Shields, Aberdeen, and other places are co-operating in a $5,000,000 organization that will guarantee the delivery of fish direct from the sea to the consumer. It was originally intended, the Yorkshire Evening Post states, that the scheme should be a local one, and its initial capital was only $25,000, but it has since developed into a national undertaking and the capital was increased first to $250,000, then to $1,250,000, and now stands at $5,000,000. Hull was the pioneer port of the scheme, but the plan is being extended to other ports along the coast so that ultimately the whole trawling industry of the country will form one big fish catching and distributing agency.

The idea grew out of a desire on the part of trawler owners to eliminate waste, to reduce the price of fish to the public, and to guarantee that the public obtain supplies that are fresh in every sense of the word. The scheme of distribution is by means of a fleet of motor "shops" of special construction and design and fitted up with counters that display the fish in a manner similar to that of ordinary retail shops. These motor vans operate from the dock side to the various distributing centers, covering all the streets and thoroughfares in and around the ports.

When the radius of distribution is beyond the capacity of the motor shops, larger lorries will be utilized as well as railway transit. In any case the method of distribution will be governed by speed and the ability to keep the fish fresh. Special wells have been fitted to the shops in which the fish is kept until sold, and special staffs have been engaged to handle the fish in such a manner as will guarantee its reaching the public in a fresh and proper condition.

In outlining the scheme to a newspaper representative the general manager of Fresh Fish Supplies, Ltd., stated that negotiations are in progress all over the country for establishing a big chain of motor shops operating from all ports. They are already installed in the East Riding of Yorkshire, and the necessary arrangements have been made for opening up in Manchester and other big centers.

The Automotive Book and Catalog Review

Lane Electric Cranes. Bulletin of these from N. B. Payne & Co., New York, sole agents. 8½ x 11, 8 pp.

Describes the points of merit of the cranes, and gives the principal dimensions of standard sizes now made.

Tire Pump Data and Engine Driven Tire Pump Data. Bulletins from Kellogg Mfg. Co., Rochester, N. Y., to S. A. E. members. 4¼ x 7¼. 6 and 18 pp., respectively.

These are bulletins which are being sent out to the S. A. E. members and others in a size to fit the society data books. They describe the installation of the pumps on various cars and trucks, and in various positions.

Grinder Book. Columbia Mfg. Co., Belleville, Ill. 3¼ x 6 booklet of 20 pp.

Descriptive of this company's line of grinders and buffers, countershafts and presses for hardware, mill supply and automobile trade.

Burd Piston Ring Directory. 1920 edition, 4 x 6¾, 108 pp. Burd High Compression Ring Co., Rockford, Ill.

This new edition of this well known and extremely useful work contains a large amount of new data. It gives the sizes of piston rings used on practically every American motor car, truck and tractor. From it one learns that there are engines now made in this country varying from 2 in. bore up to 10 in.

Bulletins. W. S. Rockwell Co., New York, 8½ x 11, varying number of pages.

These recent bulletins of Rockwell furnaces and furnace accessories describe a varied line, some of the titles being Shipyard Angle and Plate Heating Furnaces, Handling Devices in Heat-Treatment Room, Function of Oil Burners, Saw Hardening Furnace, etc.

Molybdenum Commercial Steels. Book, Climax Molybdenum Co., New York, N. Y., 8¾ x 11, 78 pp., stiff cardboard binding.

A very interesting description of molybdenum, what it is, where it is obtained, and for what it is used. Complete description of the molybdenum steels, which appear to have been developed solely for automotive vehicle and parts manufacturers.

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Piracy of Trade Marks Abroad

(Continued from page 21)

ownership at the U. S. Consulates at Shanghai and Tientsin, and at the Chinese Maritime Customs. Similar registration at the U. S. Embassy at Tokyo is advised.

American marks may also be protected in China against counterfeiting or imitation by Japanese traders, by proper registration of the mark in Japan, as above stated.

With regard to the situation in Poland relative to patents and trade marks, the following statement will be of interest:

Advices from the Polish National committee, recognized by the American and allied governments, that at the present time the former administrative practice with regard to patents and trade marks is being observed in Russian, German and Austrian Poland.

The Diet at Warsaw is still at work on the constitution of Poland, and statute law, as it were, is yet in the process of development.

New patent and trade mark laws may be expected without great delay.

New Features in Lanchester Chassis

(Continued from page 9)

the front bearer arms and the engine back to the cross member behind the gearset, as shown in Fig. 3. There is a tubular cross member of unusually large diameter toward the rear end of the frame, the extremity of the latter supporting the fuel tank.

The steering gear consists of right and left hand threaded screws on the column, engaging with nuts which bear against rollers on the ends of a rocker secured to the shaft of the steering arm. The rake of the column is adjustable within a bracket carried on the aluminum dashboard, which is hollow to form an air and heat insulating space between the engine and the front seat compartment. The hand wheel is shown in Fig. 2, F.

Other details can be noted in the reproductions of working drawings, which are presented herewith as Fig. 2, A, B, etc.

Truck Owner Makes Transportation Record

A new record in motor truck efficiency, considering the distance traveled, time taken and size of load, was recently made by Lee B. Hawkins, of Moneta, Cal., who operates a fleet of eight Mack trucks.

A seed firm near Los Angeles wanted to ship 15 tons of seed in a particular rush to another town 225 miles away. No freight car was available, so they asked Hawkins if he could make the delivery in two days. He took the consignment, and with two of his Macks, one carrying ten tons and the other five, started out the next morning for the town of Calexico. At night a stop was made and the trip resumed at dawn. Calexico was reached in 30 hours after the start.

Arrangements were then made to receive a return load of nearly 15 tons of dried milk at El Centro, 10 miles from Calexico. This was delivered at San Diego, a distance of 100 miles. There 15 tons of fish were loaded on and delivered in Los Angeles, 130 miles more. Reaching home at Moneta at midnight, one of the trucks hooked onto a trailer and delivered 17½ tons of tomatoes by next morning to a cannery 25 miles away. At a town nearby, 7½ tons of well casing were taken on and delivered that night at Elsinore, 100 miles away over the mountains.

Compare this performance of almost 1,000 ton-miles a day with what would have been done by railroad transportation. No more remarkable example of motor truck efficiency could be asked for. There have been many instances of unusual performances of trucks that have been staged as stunts by dealers or manufacturers, but this is a case where the owner capitalized on the proved utility of his trucks. It shows what any other owner can do if he solicits return loads in a persistent manner.

German Appeal for Crude Oil Farm Engine

Prof. Martiny appeals in Der Motorwagen to German explosion engine designers to develop a crude oil engine sufficiently light in weight to make it suitable for farm tractors. His reasons are that the only fuels now available in sufficient quantity in Germany are gas oil, tar oil produced by the distillation of brown coal and tar oil obtained as a by-product in the production of benzol from coal. In many parts of Russia also the only fuel available is crude oil. The engines that are now being built to burn crude oil are entirely too heavy; considerations of traction resistance and packing of the soil, especially in deep plowing, demand a light engine.

Better Materials for Spark Plug Porcelains

According to a recent article in one of the chemical journals, two investigations have found the trouble with present porcelains used for spark plugs. They show that (1) feldspar as a flux is injurious and that (2) improvement is made by replacing quartz by minerals or synthetic mixtures which are more constant in volume when heated The remedies suggested are the replacement of feldspar by other fluxes as silicates or alkaline earths either natural minerals or artificial mixtures, on the one hand, or to replace quartz by substances not subject to inversions or other volumetric changes, such as highly calcined kaolin or sillimanite, either natural or artificial.

Alcohol from Coke in England

An English inventor, Ernest Bury of the Skinningrove Iron & Steel Works, has succeeded in extracting ethyl alcohol and its derivatives from coke oven gas. The practical working of this process in the company's works revealed an average yield of 1.6 gallons of alcohol per ton of coal carbonized. On this basis the application of the Bury process to the entire amount of coal reduced to coke in the United Kingdom would yield 23,416,000 gals. The recovery of alcohol at the gas works would yield a further 27,000,000 gals., or of alcohol and benzol together of 114,000,000 gals. toward the country's requirements of 160,000,000 gals. per year.

A reorganization plan for Fulton Motor Truck Co., Farmingdale, L. I., has been proposed, which if carried through will save this concern from dissolution. Lacking this, the plant and equipment will be auctioned off.

La Carrosserie Automobile, a French publication devoted to carriage builders, has resumed publication, which was interrupted by the war. The 33d issue, just out, is an unusually fine piece of work.

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The New and Unusual in the Automotive Field

Stewart Heavy Fuel Burning System Handles Kerosene Adequately — Westinghouse Engine Heater Designed Along Novel Lines—Myers Magazine Oiling System

It will be the policy of Automotive Manufacturer (as in Automotive Engineering) to present on these pages each month some car, truck, aeroplane, boat, tractor, engine or other unit, which presents unusual and decidedly different engineering features

Stewart Heavy Fuel Burning System

With Pennsylvania crude oil above $6 a barrel and still going up, with such a shortage of crude oil that oil men are predicting a price of $10 a barrel this year, and with all the countries of the world turning to oil as a fuel for ships, locomotives, stores, business buildings and elsewhere, which the actual need before any such changes were contemplated was greater than the supply, a situation exists which gives point to any fuel system that will burn the heavier fractions.

Present maximum production (that in 1919) produced about 2½ billion gals. of motor fuel. If all of the 8,000,000 cars and trucks now in use (as of April 1) were to require 400 gals. a year, 3.2 billion gals. would be needed, not to mention the increase which is now approximating 200,000 cars and trucks, or a fuel-consuming power of 80,000,000 gals. per month. Could all cars and trucks use kerosene, so that all the present fuel and all the kerosene could be mixed together and sold as one liquid, the quantity would be approximately doubled, or say 4¾ billion gals. Here, then, is the argument for heavy fuel vaporizers, with them no trouble except that of distribution, without them actual shortage, high prices, rationing, discontent, lack of use, restriction of manufacture, men out of work, money lost to business, etc.

The Stewart heavy fuel system, a section of which is shown in Fig. 1, has been perfected by the Stewart-Warner Speedometer Corp., Chicago, to handle kerosene and the heavier distillates. It utilizes an initial very fine mechanical division of the fuel into what might be called a fog, and its fixation as a gas by means of heat, air being added subsequently.

The chief problem in carbureting the so-called heavy fuels for use in automotive engines lies in the difficulty experienced in dividing them finely enough to permit of effective handling in the intake system, and to permit of complete combustion within the time available in the engine cycle.

Ultimate physical division of a liquid is accomplished when it is vaporized. No available spraying or other purely mechanical method can so finely divide a liquid. The change in state known as vaporization is accomplished only through a breaking down of the forces which cause the molecules of the liquid to aggregate into a continuous mass.

It has been proposed to supply an engine with a mixture of air and fuel vapor. This is ideal in the cases of fuels having low boiling points; but for kerosene and like fuels the charge temperatures that must be employed to maintain the mixture in a state of dryness are prohibitively high, considering power delivery from the engine and freedom from preignitions and detonations.

The usual method of handling heavy fuels consists in passing the discharge from the carbureter through a considerable length of heated passage, where heat is given up to the fuel to cause its vaporization. But in this process the temperature of the air of the charge is raised to equality with that of the fuel. Thus, when dryness is attained, and its attendant advantage of perfect distribution among the cylinders is realized, the charge exists at a temperature equal to the end-point of the fuel.

It is a property of vapors that when they are condensed the substances which compose them reappear in minute liquid globules, each so small as to be in perfect entrainment in the air with which it is surrounded. These microscopic spheres represent the minimum dimension in which the substance can exist as liquid. Once a liquid has been made to assume this fog form it can be handled and distributed in the intake system as perfectly as can a vapor—provided the globules are not subsequently forced into contact with each other, as in passing through a small bore, tortuous passage, or a narrow throttle opening.

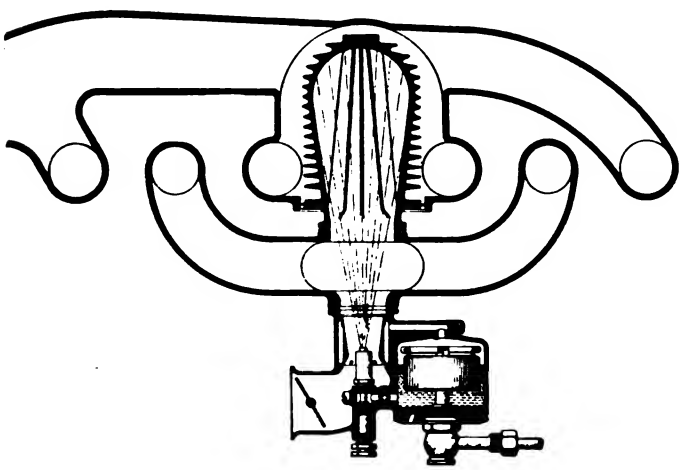

Fig. 1—Section through Stewart heavy fuel system, indicating initial heavy spray into heating chamber

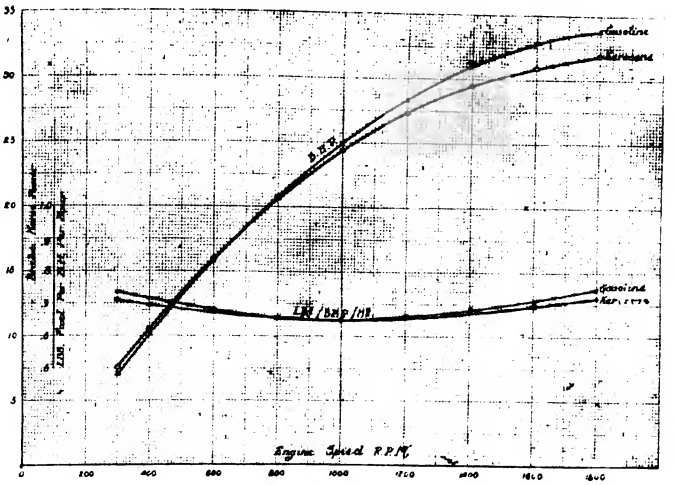

Fig. 2—Power and fuel consumption under full throttle opening—power curve above, consumption curve below

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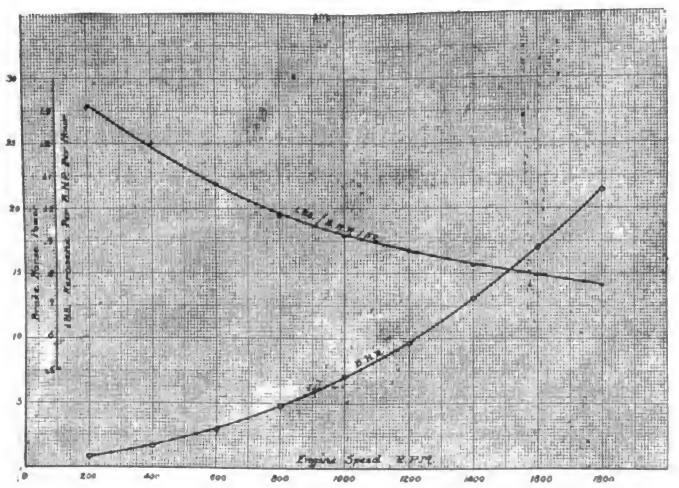

Fig. 3—Power delivery and consumption on kerosene in throttle runs, equal to engine loads driving 3,400 lb. vehicle

Furthermore, a fog-like mixture of fuel and air retains its structure and advantageous characteristics independently of how much its temperature may be lowered. And when such a charge is subjected to compression within the cylinder, the fog particles are reevaporated by the heat of compression, giving a dry and homogeneous charge for ignition.

In the Stewart heavy fuel system the fuel is initially finely divided mechanically at the carbureter spraying nozzle. This takes place in the presence of the air of the mixture, in an elementally simple, but very perfect metering structure. At the spraying nozzle extremely high velocities are impressed upon the fuel globules. They thus possess sufficient energy to cause them to leave the air stream and continue on into the exhaust heated vaporizing chamber. Here the fuel is completely and instantaneously vaporized.

The exceptionally fine division by direct spraying at the carbureter nozzle is an expedient for securing uniform distribution of the fuel over the vaporized surface, to the end that its capacity may be high and its size as small as possible.

Only the fuel of the mixture enters the vaporizer. The air does not enter, any more than does one's breath when blowing into the neck of a bottle.

The vapor formed in the heated chamber flows out over the incoming fuel spray and gives up a portion of its heat directly to the liquid globules. As a matter of fact a considerable portion of the liquid most finely divided at the nozzle never reaches the heated surface, its vaporization being accomplished by direct transfer of heat from vapor to liquid. In this way the temperature of the vapor, as it leaves the neck of the vaporizer, is never higher than that of saturation at the pressure of the intake system, since the vapor always exists in the presence of its own liquid.

It is noticeable that vaporization proceeds under the condition of minimum pressure. Full advantage is taken of the direct relationship between pressure and boiling temperature of a liquid in this system, to minimize the temperature rise necessary to the process of vaporization.

As the vapor issues from the heated chamber it condenses, upon contact with the cool air of the mixture, and raises the temperature of the latter from that of the atmosphere by an amount slightly greater than the equivalent of the latent heat of vaporization of the fuel composing the vapor.

Very obviously, the resulting mixture temperature is far below that of a corresponding mixture formed by heating of the whole charge, and is the minimum possible consistent with realization of perfect charge quality and distributability.

In a fitting of the Stewart heavy fuel system, made to secure maximum economy of operation, the charge temperature has a constant value (within plus or minus 3 to 4 F. deg.) under all conditions of operation, from idling to full load at highest speed. The only change in conditions that can alter the mixture temperature is modification of the ratio of fuel to air in the mixture. An enrichment causes a rise in charge temperature, since more heat is then given up to the air by the fuel vapor. The converse is equally true.

Particular attention is directed to the inherent control of the vapor temperature, and, therefore, of the mixture temperature, brought out in the foregoing discussion of the vaporizing chamber. As a consequence, no regulation of the exhaust gas sweeping the chamber is needed.

The compensation characteristics of the carbureter are equally inherent and perfect, being such that suitable mixture proportions are maintained without structural or operating complications. A carbureter possessing these natural metering characteristics lends itself particularly well to fixed setting to a specification. The service and other advantages of this feature must commend themselves to producers of automotive apparatus.

Fig. 2 shows the power and fuel consumption and gives a direct comparison of gasoline and kerosene performance, while Fig. 3 shows a power and consumption curve on kerosene alone.

Electric Automobile-Engine Heater

Keeping an automobile engine warm during normal winter weather, as the car stands in the garage, an electric auto-engine heater recently placed on the market fills a long felt want of automobile owners. It comprises one of the latest additions to the list of appliances made by the Westinghouse Elec. & Mfg. Co., of East Pittsburgh, Pa.

Fig. 4—External view of new Westinghouse car and garage heater

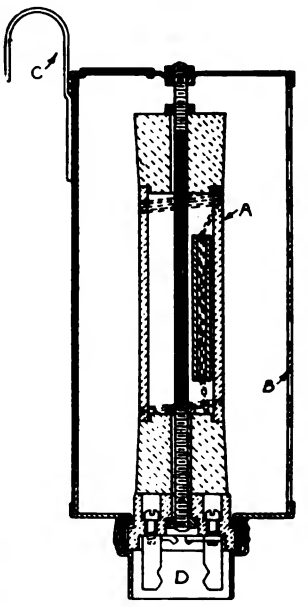

Fig. 5—Sectional view of Westinghouse heater showing construction

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By the use of this method the heat is concentrated at the engine and carbureter, where it will do the most good. Thus, on cold mornings no difficulty will be experienced in starting the engine as the temperature of the latter will always be well above that of the outside air.

The appliance is ruggedly built, practically indestructible and is shown in Figs. 4 and 5. The heating unit, A, Fig. 5, is protected by a strong perforated sheet-metal guard, B, entirely surrounding the heater. A rigid metal hook, C, allows the heater to be hung anywhere under the hood. The flexible cord is long and the plug can be attached to any lamp socket. Altogether, it is well built, with no delicate parts to get out of order.

The power consumption is only 100 watts. The initial cost and the expense while in use are both small as to be almost negligible. The cost of operating is less than one cent an hour (based on power rate of 10 cents kwh.). Thus, only a few cents a night, a warm engine and carbureter are insured for starting up in the morning.

Myers Chassis Oiling System

Wider and wider use of expensive cars and trucks, especially the latter which have become a business help of no mean moment and entailing a tremenodus investment, has directed attention to the need for better and better lubrication for chassis parts, and incidentally to the fact that grease is not the best lubricant for these parts. This brings back the use of oil, and one new system with much to commend it, the Myers, is designed wholly for oil.

Essentially the Myers system consists of a series of hollow brackets and shackles for the spring bolts, like that shown in Fig. 6. These brackets and shackles holding oil which is wick-fed to the bearing surfaces by capillary attraction, there being no gravity feed. Felt wicks, B, E, about ¼ in. in diameter, dipping to the bottom of the oil pockets, carry the oil to the top of the pockets and then through tubular passages to the bearing surfaces, C. D. The oil after passing through the initial bearing is allowed to flow to the springs which are thus kept from stiffening.

The cored brackets and shackles hold enough oil to last from six weeks to three months under normal conditions and the filler hole is closed by a large pipe plug or by a wing plug attached by a chain.

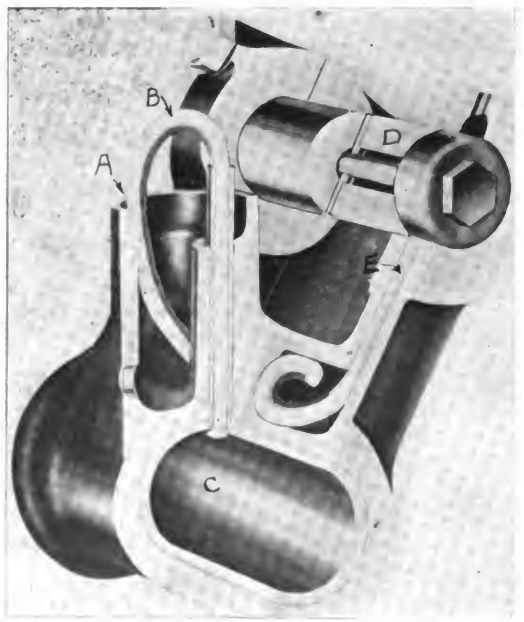

Fig. 6—Sectional view of Myers magazine oiling system on rear spring shackle. Reservoir A holds the supply of oil

This system has many important advantages, among which may be mentioned: Oil is automatically filtered and fed only in small quantities as required and only when the vehicle is in motion; dirt and water cannot reach bearing surfaces; oil is evenly distributed over the bearing surfaces and the wear on pins and bushings is practically eliminated; springs do not rust, become stiff or break near the eyes; magazine requires filling only once in two or three months and requires no attention; no oil or grease cups to break off; squeaks and rattles eliminated; springs are kept fully lubricated and the vehicle practically "rides on oil"; can be adapted to existing chassis; parts are inexpensive and their weight easily held within the limits of existing designs; automatic lubrication is a distinct asset from the user's standpoint and forms a strong selling argument for the dealer.

This system was thoroughly tested by the U. S. government and was adopted as standard on 20,000 Class B Liberty trucks used during the war. The splendid performance of these trucks under the most severe service conditions and their freedom from spring trouble is a matter of official record.

Many prominent manufacturers are now adopting the system as standard equipment.

Chassis Lubricating Co., Inc., does not manufacture, but will be pleased to co-operate with engineers and manufacturers who desire to adapt this system to their own designs and specifications.

Largest Express Motor Line Started

The Patrio Motor Express Co., of Wichita and Kansas City, Kas., the first million dollar organization of its kind has begun operations. Its first routes are between Atchison and Kansas City via Leavenworth and other intermediate points, and St. Joseph and Kansas City. Trains of two large motor trucks each will make trips every day regardless of weather conditions. In the cities the trucks will stop at the loading docks and warehouses of wholesale concerns, and will pick up grain, live stock and other farm products from farmers along the route. The company for the present is running one line between Atchison and Kansas City, a distance of about 75 miles and two lines between St. Joseph and Kansas City, a distance of about 25 miles.

The personnel of the company is composed of mechanical engineers and transportation experts of Chicago and Kansas City. Officers of the company plan to open temporary offices in Kansas City.

The three lines now in operation are but a few of the many the company contemplates starting. Within the next six months it will establish freight and express lines operating between all of the principal cities in Kansas, Nebraska and Missouri, using about 250 large motor trucks.

To secure the greatest efficiency, and because of the enormous tonnage that will move continuously, the company has found that it will be necessary to erect or secure large fireproof, modern freight and express warehouses. These will be erected in the larger cities of the three states.

Gasoline in England has now reached a cost of 90 cents a gallon.

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Current Automotive Metal and Supply Prices

Production for February was at the highest rate in more than a year, and to all appearances can be expected to increase unless new labor trouble develops.

Iron and Steel Despite this and the fact that the railroads have not yet come into the market for equipment, prices have moved up all around, No. 2 pig being up $1 a ton, and basic $2. Rolled shapes are correspondingly higher. There is strong bidding for sheets, and the price has gone up $10 a ton and may go higher. Automobile interests are blamed for this.

Copper and Aluminum Copper remains heavy because of continued lack of domestic and export demand. Lake has been below 18¾c all of March to date. Aluminum, too, is in the doldrums, and little or no business is going on. Prices remain around 31-33c New York for virgin 98-99 per cent.

Lead continues strong and high, approximating 10c. The leading interest advanced the price ¼c to 9.25 New York early in March, and outside interests promptly moved up from 9.35 to 9.50. There is very little tin being sold, the only activity being among the dealers. There has been a big decline in London. Arrivals to March 9 totalled 500 tons with 5,465 tons reported afloat. Antimony is strong and spot lots are quoted at 12c New York, duty paid.

Lead, Tin, Antimony

Further recessions in domestic and export demand have brought the price of zinc to lower levels. A slightly firmer tone is noted. Ferromanganese continues in strong demand, and prices are higher. Domestic has gone to $175-185, and some interests are asking $190 for second quarter delivery. English is quoted at a shade under $200. Spiegel is a little higher, but ferrotungsten is lower.

Zinc and Other Metals

Old Metals All the scrap nonferrous metals are higher except turnings, while steel and iron scrap is lower. This, too, despite lower copper prices on the one hand and higher prices for iron and steel on the other.

Chemicals Deliveries are the big difficulty, as it is particularly hard to find chemicals for immediate delivery, and because of this all prices are nominal. Soda ash is scarce and the price high; caustic potash firm.

Fabrics Cotton yarns are firm as is cotton cloth, but burlap is easier. Wool is higher.

Rubber is a little easier in both Para and plantation grades. Smoked sheets are down to 46-48 and are expected to go lower. Leather trading is light, and prices are lower but firm, Bogotas being quoted at 40 against 48 last month. All crude petroleum and products are up, Pennsylvania being quoted at $6.10, at which record level premiums of 25 to 35c a barrel are being paid. Production figures indicate that this is a natural outcome, and that still higher prices may be expected. Gasoline now at 30½c to consumers is expected to go to 35 and oil men predict 40c.

Other Materials

The prevailing prices compared with last month are as follows. Every effort is made to have these as accurate as possible, but none are guaranteed. Many are obtained through trade sources dealing in large quantities, so these may not be realized on smaller quantities:

	Feb. 9	Mar. 9
Acid, Sulphuric, 66°.....ton	$22.00 —25.00	$22.00 —25.00
Alcohol, Ethyl, 97 p.c.....gal.	nominal	6.00 — 7.00
Alcohol, denatured, 190 proof, gal.	.71 — .73	.67 — .74
Aluminum, Ingots No. 1 99% pure, carload lots.....lb.	.35 — .38	.35 — .38
Ammonium Chloride (Sal-Ammoniac) white, granular....lb.	.13¼— .17½	.17 — .19
Antimony, Asiatic .....lb.	.12½— .13½	.12
Babbitt Metal, best grade.....lb.	.90	.90
Babbitt Metal, Commercial....lb.	.50	.50
Beeswax, natural crude, yellow.lb.	.42 — .45	.42 — .45
Carnauba No. 1 Wax.....lb.	.80 — .88	.80 — .88
Caustic Potash (85-92 p. c.)..lb.	.35 — .42	.35 — .42
Caustic Soda, 76 p. c.....100 lb.	4.35 — 4.50	4.85 — 5.25
Pumice, Ground (domestic)....lb.	.02½	.02½
Shellac, TN .....lb.	1.10 — 1.15	.....
Orange, superfine .....lb.	1.20 — 1.30	1.65 — 1.70
Tin, Metallic straits pig.....lb.	.66	.60¼
Turpentine, spirits of crude.....	2.04	1.99
Zinc, Western Spelter.....lb.	.10½— .11½	.086
No. 9 base casks, open.....lb.	.14½	.14

IRON AND STEEL, PIG, BARS, ALLOYS, OLD METAL

Pig, per ton—	Feb. 3	Mar. 9
No. 2 X, Philadelphia§.....	$44.35	$45.35
No. 2, Valley furnace†.....	40.00	41.00
Basic, delivered, eastern Pa.....	41.40	43.40
Basic, Valley furnace.....	40.00	41.00
Bessemer, Pittsburgh	42.40	43.40
Malleable, Valley	42.00	42.00
Bars—		
Merchant iron, base price.....	4.25c	....
Refined iron base price.....	4.25c	.450c
Soft Steel—		
¾ to 1⅞ in., round and square..	3.52—4.25c	3.52—4.25c
1 to 6 in. x ⅜ to 1 in.....	3.52—4.25c	3.52—4.25c
1 to 6 in. x ¼ and 5/16.....	3.62—4.35c	3.62—4.35c
Rods—⅝ and 11/16.....	3.57—4.05c	3.57—4.05c
Bands—1½ to 6 x 3/16 to No. 8..	4.22—4.75c	4.22—5.25c
Ferromanganese, 76% to 80% delivered producers' price.....	$155.00 to 160.00	$175.00
Spiegel, 18% to 22% furnace, spot	55.00 to 57.50	57.00 to 60.00
Ferrosilicon, 50%, spot, delivered	85.00 to 95.00	85.00 to 95.00
Ferrotungsten, standard, per lb. contained, furnace	1.25 to 1.40	.90 to 1.10
Old Metal		
Heavy steel scrap, Pittsburgh...	$28.00	$27.00
Heavy steel scrap, Philadelphia..	26.50	25.50
No. 1 cast, Pittsburgh.....	34.00	34.00
No. 1 cast, Philadelphia.....	41.00	40.00

†Silicon, 1.75 to 2.25. §Silicon, 2.25 to 2.75.
Ferrosilicon prices at Ashland, Ky., Jackson and N. Straitsville, O.

BOLTS AND NUTS

	Feb. 3 % off list	Mar. 9 % off list
Machine bolts, c.p.c. and t. nuts, ⅛ x 4 in.:		
Smaller and shorter.....	40-5	35
Carriage bolts, ⅛ x 6 in.:		
Smaller and shorter, rolled threads	45-5	40-5
Cut threads	40-5	30-10
Semi-finished hex. nuts:		
⅛ in. and larger.....	65	60-5
9/16 in. and smaller.....	70-10	70-5
Tire bolts	60-10	55-10

The above discounts are from November 1, 1919.

BRASS, COPPER SHEETS, SHAPES, VIRGIN METAL, SCRAP

	Feb. 9	Mar. 9
Copper, Lake, ingot.....lb.	$0.19½	$0.18½
Copper, Electrolytic .....lb.	.19¼	.18⅜
Copper, Casting .....lb.	.19	
Copper sheets, hot rolled.....lb.	.29½	.29½
Copper sheets, cold rolled.....lb.	.31½	.31½
High brass wire and sheets....lb.	.25¼	.26½
High brass rods.....lb.	.23¾	.23¾
Low brass wire and sheets....lb.	.27¼	.28½
Low brass rods.....lb.	.28	.29½
Brazed bronze tubing.....lb.	.37	.38¼
Seamless bronze tubing.....lb.	.33½	.33½
Seamless brass tubing.....lb.	.30½	.32
Old Metal		
Copper light and bottoms.....	12.50—12.75c	14.50c
Brass, heavy	7.50— 8.25c	10.50c
Brass, light	5.80— 6.60c	7.75c
Heavy machine composition.....	15.50c	15.75c
No. 1 yellow brass turnings.....	10.00c	9.75c
No. 1 red brass or comp. turnings	13.00c	12.75c

CRUDE RUBBER

	Feb. 9	Mar. 8
Para, Upriver fine.....lb.	$0.44 —$0.46	$0.42½—$0.44
Upriver coarse .....lb.	.33 — .35	.31½— .35
Upriver caucho ball.....lb.	.33½— .34½	31½— .34½
Plantation, first latex crepe...lb.	.50 — .54½	.46¼— .49
Ribbed smoked sheets.....lb.	.49 — .51	.46 — .48
Brown crepe, thin, clean....lb.	.48 — .48½	.41 — .43

PETROLEUM PRODUCTS

	Feb. 10	Mar. 16
Oil—Pennsylvania Crude	$5.50	$6.10
Kansas and Oklahoma Crude.....	3.00	3.50
Gasoline, Motor, garages, steel bbls.....	.26½	.28½
Consumers, steel bbls.....	.28½	.30½
Lubricating Oil, black, 29 gravity.....	.25—.35	.25—.35
Cyl. light filtered.....	.60—.70	.70—.75
Dark filtered	.60—.70	.70—.75

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Men of the Automotive Industry

Who They Are What They Are What They Are Doing

C. M. Eason has resigned as chairman of the tractor bearings division of Hyatt Roller Bearing Co., Chicago, to take charge of a project organized at Moline, Ill., the Moline Engineering Development Co. Mr. Eason, however, will continue to serve the Hyatt organization in an advisory capacity. Among the large stockholders of the Moline Engineering Development Co. are T. N. Funk, superintendent of the Moline Plow Co., and F. G. Allen, former president of the company. The new organization will devote its attention to investigational and advisory work along engineering lines, especially relating to tractors and other farm equipment.

D. Kirke Moore, general manager of the bearings and axle business of the Standard Parts Co., has resigned that post and is succeeded by J. C. Ochs, in charge of the business which takes in both the American Ball Bearing plant at Cleveland and the Hess Axle plant at Cincinnati. Ochs will divide his time between these and affairs of the Eaton Axle Co., for which he is general manager, having gone into that organization from the Torbensen Axle Co. at the time that J. O. Eaton withdrew from the latter to form his own company.

F. A. Ingalls, who was formerly president of the Ingalls-Shepard Forging Co., Harvey, Ill., has been appointed a vice-president of the Wyman-Gordon Co., Worcester, Mass., following the absorption by that organization of the Ingalls-Shepard Co. In the future this plant, which will be known as the Ingalls-Shepard division of the Wyman-Gordon Co., will be under the active management of Mr. Ingalls.

F. E. McKone has been appointed assistant secretary, Society of Automotive Engineers, succeeding Herbert Chase, who has resigned to affiliate himself with the Power Plants Corp., a Washington, D. C., enterprise, which is engaged in developing engines for automobiles and other uses capable of burning low grade fuels.

William L. Clark, well known to dealers in the east as branch manager for the N. Y. Moline Plow Co., at Poughkeepsie, N. Y., and who left the Moline people to assume the direction of sales for the Samson Tractor Co., has been made domestic sales manager for the Emerson-Brantingham Implement Co., at Rockford, Ill.

P. J. Dasey has resigned as sales manager of the Blodgett Engineering & Tool Co. to rejoin his old chief, Lon Smith, of the Midwest Engine Co., Indianapolis, Ind., and will devote his energy to the research and sales engineering lines. Dasey was associated with Smith when he served as sales engineer of the Buda Co.

A. L. Kimball, formerly chief engineer of the Fulton Motor Truck Co., has joined the Pierce Governor Co., Anderson, Ind., in the capacity of sales engineer, having the territory east of Indiana. Kimball has been experimental engineer for the Hudson Motor Car Co., Chalmers Motor Car Co., and Dodge Brothers.

Prof. O. W. Sjogren is chairman of the Univ. of Neb. department of agricultural engineering, succeeding Prof. L. W. Chase, who resigned to enter the manufacturing field. Prof. Sjogren has been connected with the department since 1909 and was acting head while Prof. Chase was engaged in war work.

R. H. Combs, who has been for several years general manager of the Prest-O-Lite Co. of Canada, Toronto, Ont., has been made general manager of the Canadian National Carbon Co., and will be located in that city. Both of these companies are enlarging extensively their facilities for production.

J. J. Loftus, sales engineer for Reed-Prentice Co., Worcester, Mass., with headquarters in Detroit, has resigned to become associated with H. C. Wills Co., Marysville, Mich. Mr. Wills formerly was chief engineer of the Ford factory. His company is building an automobile plant at Marysville.

W. V. Houck, factory manager of the Buffalo Metal Goods Co., Fillmore avenue, Buffalo, N. Y., a subsidiary plant of the General Motors Corp., has severed his connections with that firm to become vice-president and general manager of the O'Neil Iron Works, Inc., Buffalo.

L. R. Keim has been appointed general sales manager of the R. D. Nuttall Co., Pittsburgh, Pa., well known manufacturer of gears. Keim was manager of the tractor department of the Nuttall company at Chicago. His headquarters will be at the Pittsburgh plant.

J. G. Utz, known through his long connection with the Standard Parts Co., Cleveland, has resigned from that organization. Utz joined the Standard Parts Co. from the Perfection Spring Co., going as chief engineer into the new company with his old chief, Christian Girl.

H. C. McIntyre has recently returned from Germany where he was on duty in the Ordnance Department of the American Expeditionary Force with the rank of major. He has been appointed assistant chief engineer at the Rock Island Arsenal, Rock Island, Ill.

B. J. Steelman has been appointed vice-president of the Wanner Malleable Iron Co., Hammond, Ind. He formerly held the same office with its predecessor, the Hammond Malleable Iron Co. There have been no changes in the officers or management.

E. F. Jones, for the past six months vice-president and general manager Elyria (O.) Iron & Steel Co., has been elected president of the Republic Rubber Corp. and the Republic Rubber Co., at Youngstown, O., succeeding Guy E. Norwood, resigned.

Paul E. Breneman has accepted the position of chief engineer of the all-steel body division with the C. R. Wilson Body Co., Detroit, Mich. For the past 5½ years he was chief draftsman with the Edward G. Budd Mfg. Co., Philadelphia, Pa.

Earl H. Seelbach has accepted a position as assistant engineer in the truck department of the H. H. Franklin Mfg. Co., Syracuse, N. Y. He was formerly chief draftsman in the same department of the Pierce-Arrow Motor Car Co., Buffalo, N. Y.

Ralph W. Davis has resigned as chief engineer of the Mitchell Motors Co., Racine, Wis., a position which he has held for the past two years. He expects to remain in Racine and to form an automobile manufacturing company.

Guy E. Norwood resigned as president of Republic Rubber Co., Youngstown, O., his resignation taking effect at once, though he has agreed to remain as a director of the company to serve in an advisory capacity for a time.

C. E. Heckel, who was formerly a designer in the motor truck engineering department of the Pierce-Arrow Motor Car Co., Buffalo, N. Y., has accepted a position as designing engineer with the Holt Mfg. Co., Peoria, Ill.

Leigh M. Griffith, senior staff engineer of the National Advisory Committee for Aeronautics, has transferred his office from Washington to the research laboratory of the committee at Langley Field, Hampton, Va.

John H. McNamara has been elected vice-president of the Keuka Industries, Inc., Hammondsport, N. Y. He was formerly production manager of the Buffalo plant of the Curtiss Aeroplane & Motor Corp.

A. W. Green, Windsor, Trumbull county, has been elected president of the Supreme Motors Corp., with a plant at Warren, O. The company recently increased its capital from $1,000,000 to $2,000,000.

Charles Pack, chief chemist and metallurgist of the Doehler Die-Casting Co., Brooklyn, N. Y., was elected secretary and chief chemist at a recent meeting of the board of directors of that company.

George B. Fuller has accepted a position in the truck department of the Packard Motor Car Co., Detroit, Mich. He was formerly assistant chief engineer of the Glenn L. Martin Co., Cleveland, O.

Raymond C. Pollock has accepted a position as engine inspector with the Daniels Motor Car Co., Reading, Pa. He formerly held a similar position with the Standard Steel Car Co., Butler, Pa.

R. E. Davis has been appointed production manager of the Square Turn Tractor Co., Norfolk, Neb. He was formerly traction engineer with the Advance Rumely Co., Battle Creek, Mich.

Charles A. Cook has resigned as sales engineer of the Detroit Accessories Corp., Detroit, Mich., to accept the position of chief engineer with the King Motor Car Co., also of that city.

Harold S. Pierce, formerly engineer in charge of chain drive layouts on automobile work, has been appointed chief engineer of the Link Belt Co., with headquarters at Indianapolis.

L. N. Burns, who recently resigned as vice-president of the J. I. Case Plow Works Co., Racine, Wis., has been elected director of the United Motor Transport Co., Kenosha, Wis.

Horace A. Brown, Jr., with the Hyatt Roller Bearing Co. for 19 years, has been promoted to manager of the motor bearings division, with headquarters in Detroit.

George T. Homeier, who was formerly with Dodge Bros, Detroit, Mich., is now general superintendent of the Lake Shore Engine Works, Marquette, Mich.

E. F. Paepper has resigned as chief engineer of the All-American Truck Co., Chicago, Ill., to accept a position with the Superior Motor Truck Co., Atlanta, Ga.

OBITUARY

Louis J. Monahan, president Universal Motor Co., and vice-president Universal Foundry Co., Oshkosh, Wis., died February 3 of influenza. He was born in Oshkosh August 9, 1876, and in 1902, with John D. Termaat, founded the Termaat & Monahan Co., manufacturer of gas engines. In 1913 they organized the Universal Motor Co., which specializes in self-contained electro-generator units. The foundry department later was incorporated separately as the Universal Foundry Co. Mr. Monahan was a member of the American Society of Mechanical Engineers and the Society of Automotive Engineers.

J. E. Wright died recently at his home in York, Pa. He was an old automobile and carriage man, one of the organizers of the Columbia Buggy Co., Hamilton, O., and later one of the founders of the Allen Motor Co., Columbus, O., of which he was vice-president and sales manager for many years.

Additional Notes of Manufacturers

Topp-Stewart Tractor Co., Clintonville, Wis., at its annual meeting determined upon a production of 350 to 400 machines for 1920, compared with 100 machines in 1919. A new issue of $250,000 of 8 per cent preferred stock will be made to finance the purchase of additional equipment, materials, etc. Edward T. Boland is factory manager

King Motor Car Co., Detroit, has bought a tract comprising 15½ acres as the site of new works. This is on the west side of the city, east of the River Rouge, and is almost surrounded by railroads. Modern factory buildings will be built as rapidly as conditions will allow.

Kentucky Wagon Mfg. Co., Louisville, Ky., manufacturers of Dixie Flyers, have two new buildings costing $150,000 now nearing completion. At the Chicago show orders for 2,522 cars were received in the first five days.

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Activities of Automotive Manufacturers

Where They Are Located What They Are Doing How They Are Prospering

Inland American Tractor Co. has been organized at Eau Claire, Wis., to manufacture a crawler type tractor to be known by the trade name of "Cata-Gripper," and rated to pull four bottoms. Officials of the R. D. Nuttall Co., manufacturer of tractor gears, are interested in the new company. The stockholders are as follows: Milton Ruppert, vice-president, Lester H. Keim, general manager, and R. D. Nuttall, all of the R. D. Nuttall Co.; F. P. O'Malley, St. Paul banker; A. A. Robbins, president of the Producers Paper Co., St. Paul; R. B. Gillett, Edw. Hutchens, N. J. Whelen, Martin O'Brien, R. L. Meader, A. P. Hansen, M. B. Hubbard and J. P. Ott. Mr. Robbins is president and general manager of the new company.

Vreeland Motor Co., Newark, N. J., occupying temporary plant at 407-9 Elizabeth avenue, has plans under way for the construction of a permanent plant on Coit street, Irvington, for the manufacture of motor trucks, with site approximating eight acres. The initial building will be one story of brick and steel, 280 x 300 ft., and will be supplemented by two two-story structures, each 40 x 150 ft., to be equipped as a machine shop, and for general metal working, repair and storage, respectively; a one-story assembling works, 200 x 250 ft.; and two-story administration building, 50 x 180 ft. The plant is estimated to cost $350,000. E. E. Vreeland is president.

Menominee Motor Truck Co., Clintonville, Wis., a new $500,000 corporation organized recently to take over a Michigan corporation of similar name, with factory and offices at Menominee, Mich., has decided to transfer the operation to Clintonville. Owners of the company are officers and stockholders in the Four Wheel Drive Auto Co., Clintonville. This plant will accommodate the Menominee plant until new show buildings can be erected later in the year. W. A. Olen is president of both corporations.

H. H. Franklin Mfg. Co., South Geddes street, Syracuse, N. Y., has awarded a contract for a new machine shop, in connection with a new warehouse, and estimated to cost about $500,000. The die-casting business of the company will be operated as a separate feature in the future and for this purpose an organization to be known as the Franklin Die-Casting Corp. has recently been formed. It is planned to establish a works apart from the automobile plant for this branch of the business.

Cadillac Motor Car Co., Detroit, has broken ground for an addition to its plant, consisting of eight four-story buildings designed so as to be increased to six stories later. The main structure will be 600 x 800 ft., providing a total floor area of 970,000 sq. ft. Adjoining this will be a heat-treating plant, 80 x 500 ft., while the assembling work will be 360 x 800 ft. Other buildings will include steam and electric power plant, storage and administration buildings.

Armstrong Farm Tractor Co., Sweetwater, Tex., is planning for the erection of a new plant, for the manufacture of tractors, to cost about $130,000, of which about $100,000 will be expended for equipment. The initial building will be one story of reinforced concrete, 100 x 200 ft. It is proposed to develop an initial capacity of about 15 machines a day, which will be doubled later. Ira Armstrong heads the company.

Jacquet Motors Corp. of America, which has been organized with a capitalization of $100,000, and is headed by Alfred J. Jackson, Battle Creek, Mich., will buy the former branch plant of the Grand Rapids Brass Co., Belding, Mich., for the manufacture of a high-priced motor car designed by Mr. Jackson. L. W. Wilson, superintendent of the Timken-Detroit Axle Co., will be superintendent of the Belding plant.

National Exposition of U. S. Manufacturers is to be held in Buenos Aires, Argentina, opening in June. Permanent cement structures have been erected, and the co-operation of about 400 manufacturers secured. The exposition will be held at the Parque Tres de Febrero, in the Palermo district, which is about as far from the business center of the city as Central Park, New York, is from City Hall.

Southern Automobile Mfg. Co., Memphis, Tenn., has purchased a plot of seven acres in New S. Memphis and has taken a two years option on eight acres adjoining this. An up-to-date automobile plat will be started at once, the expenditures for buildings and equipment amounting to $250,000, it is said. The main building will be 350 x 120, two stories high, with an ell 200 x 120 and two stories.

Douglas Motors Corp., Omaha, Neb., has elected a new directorate including a number of banking men. The new directors include George Christopher, reelected president; William Nixon, banker, Council Bluffs, secretary; Thos. A. Fry, banker, Omaha, first vice-president; H. O. Wilhelm, second vice-president; W. H. Larned, banker, Haigler, Neb.; J. A. Person and J. D. Anderson.

Day-Elder Motors Corp., Coit and 21st streets, Irvington, Newark, N. J., has acquired property adjoining its plant at Clinton avenue and 21st street, and is having plans prepared for a new four-story unit of reinforced concrete, 75 x 252 ft., to cost $300,000. A large portion of the structure will be equipped for assembling work. W. E. Lehman, 738 Broad street, is the architect.

General Motors Corp. plans to spend $4,500,000 in additions to its Saginaw plants. The additions include increased capacity for the Saginaw Products Motor plant, costing $1,500,000, doubling of the size of the New Central Foundry at a cost of $2,000,000, and an addition of $1,000,000 cost to the new Michigan Crank Shaft Co. plant now in process of construction.

Cadillac Motor Car Co., Detroit, lost its chassis frame department by fire early in February. This building, which was a one-story frame structure fronting 159 ft. on both Cass and Burroughs avenues, was destroyed in less than an hour, the varnish, enamel and other highly inflammable materials making it a veritable torch.

Scofield Tractor Corp., Ltd., has been organized at Toronto, Ont., with a capital stock of $1,000,000 by David I. Grant, M. MacDonald, Edwin Smily and others.

Commerce Truck Co., Detroit, has purchased two more acres of land adjoining its plant and will build another addition as soon as the present one is completed.

Leonard Tractor Co., with headquarters in Gary, Ind., will build a plant at Griffith, near Gary. It is capitalized at $2,000,000.

Revere Motor Car Co., Logansport, Ind., has just completed an addition to its plant, 165 x 65 ft. and three stories high.

Fulton Motor Truck Company's plant at Farmingdale, N. Y., and all its assets were auctioned off March 11.

Mercer Motors Corp., New York, has increased its capital from $11,000,000 to $20,000,000.

Parts Makers

Interstate Drop Forge Co., Milwaukee, has been organized and a 9-acre tract close to the city obtained upon which building construction has been started. The plans call for the initial expenditure of $175,000 for buildings and equipment. The president of the new company is Wm. C. Frye, who is also president of the Chain Belt Co. and secretary of the Sivyer Steel Casting Co. Major S. M. McFedries is vice-president and general manager. Major McFedries was formerly the sales manager of the Cutler-Hammer Co. and during the war was in charge of the production division, Ordnance Department, in the Milwaukee district. C. R. Messinger, the treasurer of the company, is also vice-president and general manager of the Chain Belt Co. and the Sivyer Steel Casting Co. The directors are Edgar L. Wood, C. R. Messinger, Wm. C. Frye, S. M. McFedries, B. Fleeger, and J. M. Olmsted of the Electric Steel Co. of Chicago.

United States Roller Bearing Co., Buffalo, occupying temporary offices at 213 Ellicott square, and organized recently with a capital of $1,450,000, is negotiating for a local site for a new plant. Plans are being prepared for the first unit, affording about 40,000 sq. ft. floor space, to be equipped for a production of about 8,000 roller bearings a day. It is planned to have the plant ready for operation early in June. G. W. Tffany is treasurer.

Motor Castings Co. has been organized at Canton, O., and will occupy a plant formerly used by the Henry Miller Foundry Co. The organizers of the business are H. H. Timken, president of the Timken Roller Bearing Co.; J. G. Obermeier, factory manager of the same company; Chas. Balough, secretary of the Hercules Motor Mfg. Co.; Gordon N. Mather, vice-president of the Hercules company, and R. W. Gallagher, of Cleveland.

Spacke Machine & Tool Co., Indianapolis, Ind., has recently acquired a 23-acre tract of land on the outskirts of that city, and is planning the construction of a large factory on it. Through recent flanncing the capital has been increased to $3,750,000. The management is under the direction of Daniel S. Brooks, president; James R. Short, vice-president, and William H. McAfee, secretary and treasurer.

Durston Gear Corp., Syracuse, N. Y., at the annual meeting, elected R. M. Bean sales manager, and A. C. Bryan factory manager, directors and vice-presidents as recognition of their faithful efforts with the company, both men having been associated with the concern since 1913.

Stansell Motors, Ltd., Amherstburg, Ont., has been incorporated with a capital stock of $500,000 by William R. Stansell and William F. Park, both of Amherstburg; John B. Whitley, of Detroit, Mich., and others, to manufacture motors, engines, automobile accessories, etc.

Motor Wheel Corp., Lansing, Mich., is a merger of the Prudden Wheel Co., Auto Wheel Co., and the Gier Pressed Steel Co., of Lansing, and the Wies & Lesh Mfg. Co., of Memphis and Jackson, Tenn., and will probably be capitalized at $10,000,000.

Body Builders

Carriage Makers Club, Cincinnati, have nominated for board of governors, four of whom are to be elected: I. O. Bauer, Milt Wieman, C. B. Hopper, E. E. Friedrich, E. V. Overman, Otto Heinrichsdorf, John Oppiinger and P. J. Zimpelman. Clen Perrine, president, was appointed delegate to the convention of the Horse Association of America at Chicago. Theodore Luth was named to represent the carriage industry in the Division of Manufacturers of the Chamber of Commerce. The following new members were elected: Edgar Friedlander, C. F. Carpenter, J. H. Lutz, Fred Luth, G. Wallace Toren and C. I. Bennet.

Martin-Parry Corp., Indianapolis, which manufactures commercial and truck bodies for motor vehicles, has set aside $500,000 for extensions and establishing a bonus system for employes. It is planned to double the capacity of the works and about $100,000 will be spent in buildings. J. A. Callahan, in charge of production at the Indianapolis and York, Pa., plants, will have headquarters in the former city. F. M. Small, York, Pa., is president and R. P. Henderson, Indianapolis, vice-president.

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Brown Body Corp., Cleveland, will shortly begin the erection of a $350,000 plant for the manufacture of automobile bodies, trucks and fire apparatus. A site has been acquired on the Big Four and Wheeling & Lake Erie railroads, and the plant will include a three-story building, 60 x 260 ft., with an L 60 x 170 ft., and a saw-tooth type structure 110 x 170 ft. Contract has been placed with the S. K. Ferguson Co., Cleveland. Paul J. Brown is president and John H. Price, secretary.

Another body builder is soon to be added to the growing colony of body builders for the automobile industry in Kalamazoo, Mich., it is intimated through the turning of one of that city's carriage building plants to body building. New interests have taken over the plant of the American Carriage Co. for the purpose of building bodies and tops for passenger cars. The new concern which is to be formed to carry on this operation is to be capitalized at $150,000.

Mullins Body Co., Salem, O., for the seven months ended with December, after a deduction for taxes, earned approximately $300,000. Te balance sheet as of December 31, 1919, showed net quick assets of better than $2,000,000, equal to $10 per share on the common stock after deducting $1,000,000 preferred. Sales for 1920, according to estimates made, will be between 50 and 75 per cent larger than for 1919.

Commercial Body Co. has taken over the business of the Warren & Southwick Carriage Co., Columbus, O. The new company is under the active management of C. W. Finch, A. M. Lupton and C. R. Benner, and will manufacture bodies for all kinds of motor trucks. It intends to carry a large stock of bodies for several styles of trucks, but will give special attention to bodies for Ford one-ton trucks.

Mullins Body Corp., Salem, O., employes have been given the privilege of buying stock in the company and many are taking advantage of the offer. Stock is selling at $44 a share. Employes are permitted to invest up to 20 per cent of their gross earnings. Due to curtailment of its gas supply the company has arranged to use oil as fuel.

Dayton (O.) Body & Cabinet Co. was incorporated at $50,000 to manufacture commercial bodies for trucks and automobiles. Among the men behind the new enterprise are C. C. Breech, D. L. Waggoner, D. L. King, J. Davies and V. B. Duvall. The new concern, with several locations in view, hopes to be in operation by the first of next month.

Fisher Body Ohio Co., which was organized some time ago to build a plant in Cleveland, has acquired a 40-acre site at Coyt road and East 40th steet and will erect a six-story main building with 1,500,000 sq. ft. of floor space. It is said that this will be the largest automobile body plant in a single unit in the world.

Aircraft Engineering Corp., New York, has gone into the manufacture of bodies, and has secured the services of J. H. Gatoff as superintendent of Plant A, where half a million dollars was spent on equipment for air-craft manufacture. A large part of this will now be put on body work.

Schrumeier-Whitney Co., Minneapolis, is planning a four-story concrete and glass factory to cost approximately a quarter of a million dollars. The company has embarked upon a tremendous policy of expansion, based on its unusual business in motor truck bodies.

Highway Trailer Co., Edgerton, Wis., which recently completed an addition, will break ground March 10 for another unit, 60 x 200 ft., costing $45,000. It is to be ready June 1 and will enable the company to increase its output to 25 complete trailers daily.

Waterbury (Conn.) Body Corp., organized to manufacture automobile bodies for trucks and jitney buses, has already begun operations. Carl Eckhardt is president and Louis M. Raffel is secretary, treasurer and general manager.

W. S. Seaman Co., Milwaukee, Wis., makers of automobile bodies and truck cabs, has been purchased by Nash Motors Co., and will be continued as a source of supply of bodies for the Nash plants at Kenosha and Milwaukee.

Lull Carriage Co., Kalamazoo, Mich., has been acquired by Dort Motor Co., Flint, to insure a continuous supply of bodies for Dort cars. The Lull factory is to be used as the nucleus of an extensive body and top plant.

Hoosier Cab & Body Co., Middlebury, Ind., has been incorporated with 30,000 capital stock to manufacture automobile bodies and accessories. The directors are Milton L. Williams, Harry S. Dover and Fred S. Hixon.

Marston & Beveridge hub and spoke factory at Appleton, Wis., which is owned and operated by John Tracy, has concluded its wagon work and henceforth will make spokes for motor car and truck wheels only.

Connell-Erben Corp., Scranton, Pa., has been incorporated with a capital stock of $50,000 by Edgar W. Connell and Lewis Erben, Scranton; and E. D. Morse, Clarks Summit, Pa., to manufacture automobile bodies.

Logansport Body Works has let the contract for the construction of the first unit to be built at Logansport, Ind., to Willard C. Price, of that city, at a cost of $22,000. There will be three units ultimately.

Detroit Watherproof Body Co., will erect several new units at its plant in Corruna, Mich., and make other improvements and alterations. The company's main plant is at Pontiac, Mich.

Worcester (Mass.) Auto Body and Welding Co. has issued 80 shares additional common stock having a par value of $8,000, bringing the total amount outstanding up to 30,000 shares.

Wilson Body Co., Bay City, Mich., manufacturer of automobile bodies, has taken bids for a three-story, brick and steel addition, 250 x 350 ft., to cost about $500,000, including equipment.

H. H. Babcock Co., 559 Factory street, Watertown, N. Y., manufacturer of automobiles and bodies, is planning for a new power plant for works service, to cost about $100,000.

Hayes-Ionia Co., manufacturer of automobile bodies, Grand Rapids, Mich., will erect a two-story addition to its plant at Seventh street and Muskegon avenue, to cost $160,000.

C. E. Hosbach Co., 10 North High street, Baltimore, manufacturer of auto bodies, wagon parts, etc., has increased its capital stock from $100,000 to $200,000.

Plainfield Body Corp. has been organized under Delaware laws, with $2,750,000 capital to manufacture automobile bodies.

Superior Body Co., Rahway, N. J., manufacturer of automobile bodies, has arranged for a stock issue of $500,000.

Index To Advertisers

WANTS

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Large export distributor desires open relations with automobile body manufacturer now producing five-passenger touring bodies for cars of 108 in. wheel base selling in $1,000 class. Must be able to turn out in large quantities. Address Export, care Automotive Manufacturer, Elm and Duane streets, New York City.

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Patents—H. W. T. Jenner, patent attorney and mechanical expert, 622 F St., Washington, D. C. Established 1883. I make an examination and report if a patent can be had and exactly what it will cost. Send for circular.

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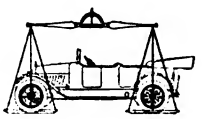

Balance is the clearest indication of mechanical refinement. It does not happen by accident. It must be scientifically *worked out*—accurately and painstakingly.

Leadership in *balanced* construction is the secret and the explanation of American Six success.

By a scientific distribution of weight in the American Balanced Six, the load is divided over each of the four wheels *almost to a fraction of a pound.* The chassis is not underweighted at the rear nor overweighted at the front. Each wheel carries an *equal* share of the load.

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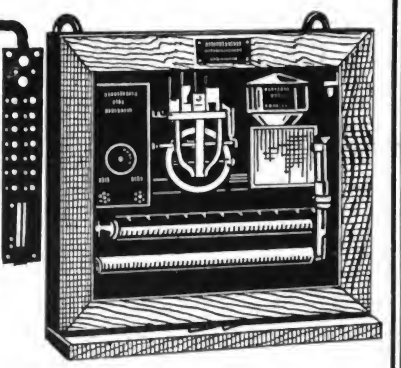

The Leeds & Northrup Curve-drawing Potentiometer Pyrometer in connection with the Leeds & Northrup Furnace Indicator with Signal Lamps does the work of a central station operator using switches to control signal lamps at the furnace. It does more effective work than any central station operator could do, because it signals the furnace operator continuously. It also tells him just how many degrees the temperature is off and keeps a continuous record of the temperature.

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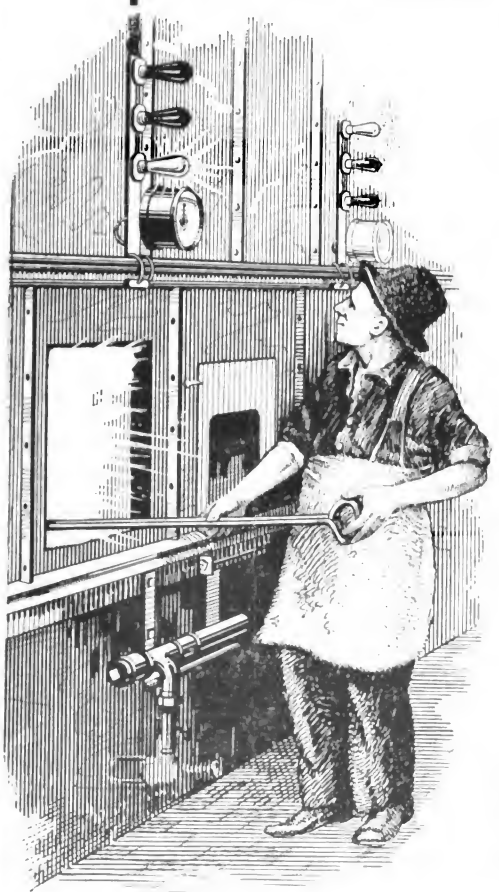

In some furnaces, particularly large ones, it is advantageous to use two thermocouples, the recorder being fitted with a commutator, so that it reads first on one and then on the other thermocouple. Simultaneously a distinguishing lamp is lit at the furnace, to show which thermocouple is being measured. This has been found highly useful in studying temperature variations in the furnace due to method of charging, method of firing, opening doors, location of charge, etc.

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Take a piece of Duxrane Top Material in your hand and treat it rough—scrub it together back and forth unmercifully, precisely as a washwoman scrubs clothes. Do it again and again (say 35 times) and then examine the result closely—you will find absolutely no mark or crack in the material and not even as much as a mar in the finish of its surface.

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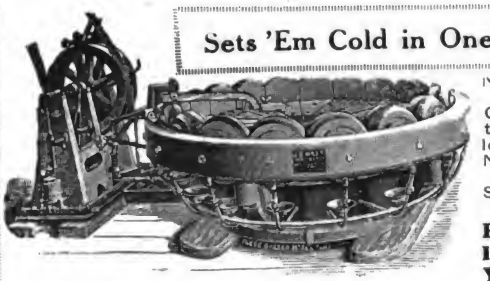

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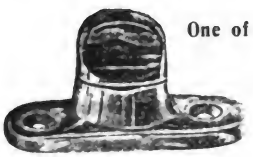

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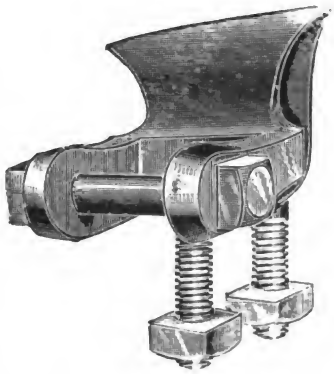

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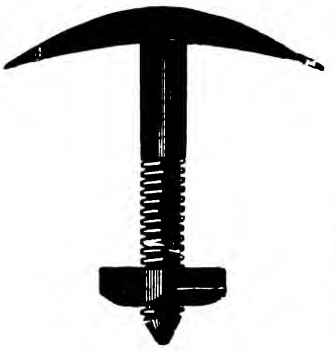

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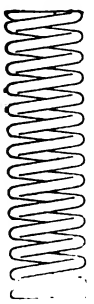

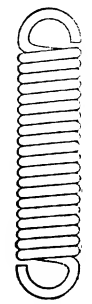

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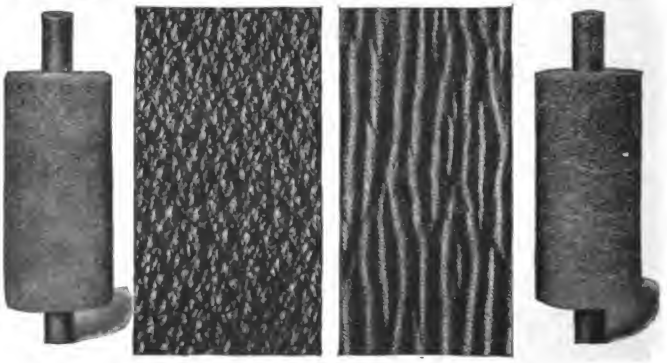

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